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Test and Evaluation

Test And Evaluation Guidelines

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Test and Evaluation Guidelines

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army

Summary. This pamphlet provides procedures and guidance to implement the policies contained in AR 73-1. It describes procedures and guidance for executing the Army's testing and evaluation program. It applies to all systems acquired under the auspices of the AR 70-series and AR 25-series. It describes procedures for planning, executing, and reporting test and evaluation activities in support of system acquisition, describes the roles and missions of the test and evaluation community, describes guidelines for preparing and staffing the test and evaluation master plan and critical operational issues and criteria, and provides guidance for planning, executing, and reporting all developmental and operational test and evaluation activities.

Applicability. This pamphlet applies to the Active Army, the Army National Guard, and the U.S. Army Reserve.

Internal control systems. This pamphlet is not subject to the requirements of AR 11-2. It does not contain internal control provisions.

*This pamphlet supersedes DA Pam 70-21, 10 May 1976; DA Pam 71-3, 15 Oct 1979; TB 18-102, 1 Mar 1984; and TB 18-104, 20 Aug 1982.

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DEPARTMENT OF THE ARMY PAMPHLET 73-1

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Part One
Test and Evaluation in System Acquisition

Chapter 1
Introduction

1-1. General
Developing and fielding Army systems that achieve the required performance and are operationally effective and suitable represent significant challenges to all involved in the system acquisition process. The procedures and guidelines in this pamphlet-

a. Apply to all systems developed and managed under the auspices of AR 70-1; these systems are referred to as materiel systems in this pamphlet. This category includes systems that contain computer hardware and software specifically designed, configured, and acquired as an integral element of the system and needed so that the system can fully perform its mission (Materiel System Computer Resources).

b. Apply to all systems developed and managed under the auspices of AR 25-3; these systems are referred to as information systems in this pamphlet. As used in this pamphlet, the term information system applies to systems that evolve, are acquired, or are developed and that incorporate information technology. It applies to all information systems of the five information mission area (IMA) disciplines not developed and managed under AR 70-1. It encompasses automated information systems, except those that are used exclusively for cryptological activities or those acquired under the National Foreign Intelligence Program for operational support of intelligence and electronic warfare systems.

1-2. Scope
One of the fundamental elements of the acquisition process is test and evaluation (T&E). The primary objective of T&E in support of the acquisition process is the verification of developmental and operational goals and objectives. The structuring and execution of an effective T&E program is absolutely essential to the acquisition and fielding of Army systems which meet the user's requirements. There are many elements integral to a successful T&E program. This pamphlet provides procedural guidance to implement the policies in AR 73-1, Test and Evaluation Policy, with regard to planning, executing, and reporting T&E in support of the acquisition process. Specifically, this pamphlet provides procedural guidance in the following areas:

a. Establishing and conducting a Test Integration Working Group (TIWG).

b. Preparing and staffing Critical Operational Issues and Criteria (COIC).

c. Preparing and staffing a Test and Evaluation Master Plan (TEMP).

d. Planning, executing, and reporting Developmental Test and Evaluation.

e. Planning, executing, and reporting Operational Test and Evaluation.

f. Structuring a Live Fire T&E program.

g. Addressing reliability, availability, maintainability, integrated logistic support, manprint, threat, survivability, compatibility, interoperability, and modeling and simulation in support of T&E.

h. Planning and conducting T&E of software as an integral part of the overall T&E program of a system.

i. Acquisition of Instrumentation, Targets and Threat Simulators (ITTS) in support of T&E.

1-3. References
Required and related publications are listed in Appendix A.

1-4. Explanation of Abbreviations and Terms
Abbreviations and special terms used in this pamphlet are explained in the glossary.

Chapter 2
Army Test and Evaluation Philosophy

2-1. General

a. Test and Evaluation is an essential part of the development and fielding of all Army systems. The information generated as a result of T&E influences every action taken during the system acquisition process. Defense Acquisition Boards (DABs), Army System Acquisition Review Councils (ASARCs), Major Automated Information Systems Review Councils (MAISRCs), and In-Process Reviews (IPRs) use T&E reports generated from test data and analyses to assist in major milestone decisions. Developers require test data to provide feedback on design elements in order to assure adequate progress towards meeting user requirements. Contractors use T&E information to ensure conformance to technical data packages, and to detect manufacturing or quality deficiencies. Finally, T&E information can provide the confidence that users of fielded systems must have relative to their systems performing as required. The importance of structuring a sound test and evaluation program during the system acquisition process cannot be over-emphasized.

b. Army T&E policy provides the flexibility to allow each acquisition program to tailor a T&E strategy to achieve maximum support to the program (See Chapter 6). T&E strategies must be generated concurrent with the acquisition strategy to assure that T&E is an integral part of the acquisition program. Efficient T&E strategies that are fully integrated into acquisition programs will effectively support event-driven acquisition philosophies.

c. Modeling and simulation will be considered to support the technical and operational T&E of all systems (hardware and software) as they proceed through the life cycle. Use of models and simulations will include, but not be limited to, the identification of test parameters and drivers for field tests; determination of high risk areas; prediction of test results; assisting in the allocation of scarce test resources; and the assessment of system capabilities in situations which cannot be tested due to safety, cost, or other constraints. The extent of the use of modeling and simulation; whether existing models and simulations will be used or new ones will be developed; status of models and simulations verification, validation, and accreditation; and the degree to which models and simulations will augment test data to assist in system evaluations and assessments will be documented in the Test and evaluation Master Plan (TEMP). Models and simulations used for T&E must be

accredited and validated prior to their use for extrapolation or predicting system performance (including software, hardware, man-in-loop) (See Chapter 16).

d. Software and computer resources are essential components of both materiel and information systems. Software T&E for both of these categories of systems is accomplished within the context of the overall system development and test program. Criteria for evaluating progress and risk, including metrics, will be established to facilitate determining how well the software supports the goals of system effectiveness and suitability. Commonality in terms and T&E approaches between materiel and information systems will be emphasized (See Part Seven).

2-2. Basic Test and Evaluation Elements

Army T&E consists of several basic elements that are essential in the development and conduct of meaningful T&E. Each of these elements will be discussed in detail in this pamphlet. These basic elements are:

a. Test Integration Working Group (TIWG). The TIWG is the cornerstone upon which a smart, effective, T&E strategy is built. The TIWG consists of members of the T&E community, and has the responsibility of coordinating and integrating all test and evaluation planning and scheduling, identifying and resolving T&E problem areas, assuring accurate documentation of the T&E strategy in the Test and Evaluation Master Plan (TEMP), and assuring that all Army agencies involved in the T&E program are working towards a common goal. The TIWG members are the key players in the T&E program, and collectively structure, document, and execute the T&E program (See Chapter 8)

b. Test and Evaluation Master Plan (TEMP). The TEMP is the basic planning document for a system's life cycle T&E. It is required for all acquisition programs. The Program Manager (PM) or Materiel Developer (MATDEV) is responsible for the TEMP, however all TIWG members contribute to its development and maintenance. The TEMP describes in broad terms what testing is required, who will perform the testing, what resources will be needed to conduct the testing, and how the evaluation will be performed. Upon approval by the appropriate authority, the TEMP serves as a contract between the PM/MATDEV and the T&E community relative to the execution of the T&E strategy (See Part Two).

c. Independent Evaluations and Assessments. Critical to the decision making process is the availability of unbiased, objective evaluations and assessments of a system's capabilities.

This is achieved by the use of evaluators and assessors which are independent from the development community. The Army T&E community has both developmental and operational independent evaluators and assessors. AR 73-1 indicates which T&E agencies have independent evaluation or assessment responsibilities, and Chapter 3 of Part One further explains the roles and missions of the independent evaluators and assessors. Parts Four and Five discuss in greater detail independent evaluation and assessment procedures for the primary Army evaluators and assessors.

d. Developmental and Operational Testing. Much of the information upon which independent evaluations are based consists of data generated from testing. The two types of tests performed within the Army are developmental tests and operational tests. Developmental testing is performed in controlled environments by specially trained individuals to assess the adequacy of the system design, to determine compliance with system specifications and technical parameters, and to determine how safe the system is for operation by user troops and civilians. Operational testing is performed in realistic operational environments with typical user personnel to assist in the determination of operational effectiveness and suitability of the system. Both developmental and operational testing must address all system components (hardware, software and human interfaces) that are critical to the achievement and demonstration of contract technical performance specifications and minimum acceptable operational performance requirements specified in the Operational Requirements Document (ORD) or Functional Description (FD). Combined developmental and operational testing should be considered when there are time and cost savings, however a final independent phase of operational testing is required for beyond low-rate initial production decisions. Parts Four, Five, Six, and Seven discuss in greater detail the procedures for planning, executing, and reporting developmental and operational testing and evaluation.

e. Operational issues and criteria. There are two types of operational issues and criteria applicable to the Operational Test and Evaluation (OT&E) process. Critical Operational Issues and Criteria (COIC) define what is operationally adequate to proceed into full production. COIC are developed by the combat developer for materiel systems and theater/tactical Information Mission Area (IMA) systems and by the Functional Proponent (FP) for strategic and sustaining base IMA systems. COIC are included in Part IV of the TEMP. Additional Operational Issues and Criteria (AOIC) provide for complete and comprehensive operational evaluation of the system. AOIC are developed by the independent operational evaluator and included in the Test and

Evaluation Plan (TEP) along with the COIC. AOIC complement and supplement the COIC. See Part Three for detailed COIC guidance. See Part Five for detailed AOIC guidance.

2-3. Continuous Evaluation

Continuous Evaluation (CE) is the process that provides a continuous flow of T&E information on the capabilities of a system to all levels of decision makers. The process encourages early and frequent assessments of a system's status during development, and can result in a significant reduction of test time and costs through comparative analysis, data sharing, and use of all data sources for evaluation. It begins as early as the branch planning analysis process or battlefield functional mission area analysis for materiel systems and as early as the Project Management Plan (PMP) process for information systems and continues through a system's post-deployment activities. The CE process makes use of the basic elements of T&E described in paragraph 2-2 to create an integrated and continuous flow of information on the status of a system's capabilities. The CE process is applicable to all types of acquisition strategies and all categories of acquisition programs.

a. Objectives. The objectives of CE are listed below.

(1) Surface critical problems at the earliest opportunity so they may be addressed and resolved before they impact major decisions.

(2) Support the formulation of realistic system requirements and specifications and ensure the system is testable.

(3) Provide for early and frequent assessment and reporting of a system's status during development.

(4) Assure that the system successfully transitions from engineering into production.

(5) Reduce test time and cost through comparison analyses, data sharing, and use of all data sources for evaluation.

(6) Monitor the corrections applied and assess the adequacy of the corrective actions to be identified deficiencies.

(7) Provide assessments of system capabilities after fielding.

(8) Assure the system is operationally effective, operationally suitable and able to satisfy the mission need.

(9) Assure the system meets technical performance requirements.

b. Roles. Continuous evaluation throughout the life cycle of a system is performed by the PM/MATDEV, the independent developmental evaluator, and the independent operational evaluator. Detailed descriptions of the CE roles are contained in Chapter 3.

c. Scope. Since CE applies to all aspects of a system throughout its life cycle, it has an important role in the requirements processs, the acquisition process, T&E, and materiel release.

(1) CE in Support of the Combat Development Process (Materiel Systems) and the Information Mission Area Planning Process (Information Systems). Several primary documents are generated by the Combat Developer (CBTDEV), Functional Proponent (FP), PM, or the MATDEV which initiate the start of, and delineate the requirements of the materiel acquisition process (MAP) or the Information Mission Area planning process. These documents identify the need for the system, the functions it is to perform, the necessary operational capabilities, and the information which will be used to select the best alternative. Involvement of the CE participants in the development of these documents is crucial to ensure the system requirements are properly formed and are addressable by T&E. Figure 2-1 briefly discusses the purpose and content of these documents.

(a) Battlefield Functional Mission Area (BFMA).

(b) Mission Need Statement (MNS).

(c) Operational Requirements Document (ORD).

(d) User Functional Description (UFD).

(e) Functional Description (FD).

(f) Economic Analysis (EA).

(g) Critical Operational Issues and Criteria (COIC).

(h) Cost and Operational Effectiveness Analysis/Cost Training Effectiveness Analysis (COEA/CTEA).

(INSERT FIGURE 2-1 HERE)

(2) CE in Support of the Materiel Development Process (Materiel Systems) and the Information Mission Area Development Process (Information Systems). Program management actions, organizations, and documentation provide the basic structure for CE. Testers and evaluators monitor, review, and provide input to program management activities and acquisition program planning to ensure that adequate resources are provided for effective T&E and to ensure that CE makes the maximum possible contribution to rapid, effective, and efficient system development and fielding. The following Program Management elements are discussed in Figure 2-2.

(a) Acquisition Strategy (AS).

(b) Decision Review Bodies: Defense Acquisition Board (DAB), Army Systems Acquisition Review Council (ASARC), Major Automated Information Systems Review Council (MAISRC), In-Process Review (IPR).

(c) Project Management Plan (PMP).

(d) System Decision Paper (SDP).

(e) Integrated Program Summary (IPS).

(f) Integrated Program Assessment (IPA)

(g) Agency Procurement Record (APR).

(h) Request for Proposal (RFP).

(i) Preliminary and Critical Design Reviews, and Physical Configuration Audits (PDR/CDR/PCA).

(INSERT FIGURE 2-2 HERE)

(3) CE in Support of the Test and Evaluation Decision Process. The most critical role played by the CE process is in support of the T&E decision process. Test programs are structured to support evaluation of issues and system requirements. Planning for T&E is fully coordinated among members of the acquisition team by means of the Test and Evaluation Master Plan (TEMP) and the Test Integration Working Group (TIWG). T&E is accomplished using a cycle of successive actions and documents. For developmental T&E, it includes the independent evaluation or assessment plan (IEP/IAP), the test

design plan (TDP), the detailed test plan (DTP), the Developmental Test Readiness Review (DTRR), Developmental Test Readiness Statement (DTRS), the Test Reports (TRs), and the independent evaluation reports and assessments reports (IERs/IARs). For operational T&E, it includes the test and evaluation plans (TEPs), the Outline Test Plan (OTP), the DTPs, the Operational Test Readiness Review (OTRR), Operational Test Readiness Statement (OTRS), the TRs, and the IERs. Each of the above items is discussed in detail in Part One, Chapter 8, and Parts Two, Four, Five, Six, and Seven.

(4) CE in Support of the Materiel Release Process. AR 700-142 provides a discussion on the Materiel Release process. CE plays a vital role in determining whether materiel is suitable for release. The results of all testing, both developmental and operational, must be considered in all materiel release decisions. The independent evaluators must present positions to the MATDEV relative to any proposed materiel release, and list the factors that could prevent a full release of the system. These positions should address the following issues:

(a) The ability of the system, when fielded, to meet the contractual specifications and requirements in system performance, reliability, logistic supportability, system software design, and the human factors engineering design of the system.

(b) The degree to which the system complies with any special directions or requirements issued by a decision review body.

(c) The sufficiency of corrections to previously disclosed deficiencies, shortcomings, and problem areas.

(d) The safety assessment of the system as to its operating and maintenance procedures.

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REQUIREMENTS DOCUMENTS

1. Battlefield Functional Mission Area concepts (Materiel Systems) (See AR 71-9, AR 70-1). The BFMA is an assessment of the capability of a force to perform within a particular battlefield or functional area. The analysis is designed to identify deficiencies in doctrine, training, leader development, organizations, and materiel and, to identify means of correcting these deficiencies. The BFMA provides a basis for applying advanced technology to future Army operations and provides input to the Battlefield Modernization Development Plan (BMDP), the Battlefield Development Plan (BDP), the Mission Need Statement (MNS), and the Operational Requirements Document (ORD). Branch planning analysis for each branch is conducted by the proponent school for its mission area. The TRADOC Analysis Center (TRAC) provides analytic support to each study. Statements of the military utility of developing systems and justification for their development are contained in the results of the BFMA.

2. Mission Need Statement (Materiel Systems and Information Systems) (See DODD 5000.1, DODI 5000.2, AR 71-9 and AR 25-3). The MNS documents deficiencies in current capabilities and opportunities to provide new capabilities expressed in broad operational terms. Mission needs and resulting acquisition programs shall be based on current, authoritative threat information. The MNS states the purpose of the proposed system, where and how it will be used, the organizations that will employ it, and how it will be integrated into the force structure. It establishes readiness objectives and is the basis for integrated logistics support (ILS) planning. For materiel systems, prior to Milestone 0 (MS 0), the MNS is developed from the operational concept resulting from the BFMA. The MNS is the basis for the ORD. The CBTDEV prepares the MNS in coordination with the MATDEV, TNGDEV, and the logistician. For information systems, prior to MS 0, the MNS is developed by the FP and becomes the basis for the User Functional Description (UFD) and FD. For both categories of systems, it can support the early identification of instrumentation and test requirements, and the initial determination of critical operational issues and criteria. The statement is the basis for early planning and efforts for the TEMP.

3. Requirements Study (RS) (Information Systems) (See AR 25-1). The needs contained in the MNS are supported by a requirements study commensurate with the size and complexity of the need. The RS should address factors such as the information processing functions to be performed; the problems that will be solved by acquiring new or additional equipment; and the nature of the information to be generated.

Figure 2-1

3. Operational Requirements Document (ORD) (Materiel Systems) (See DODI 5000.2, DOD 5000.2-M, AR 70-1, AR 71-9). The ORD is the formal requirements document which must be approved before a program can enter engineering and manufacturing development. It is approved at MS I, updated and expanded at MS II. It is prepared primarily by the CBTDEV in coordination with the MATDEV, TNGDEV, logistician, MANPRINT Planner; developmental and operational testers and evaluators. The ORD states the threat, RAM, technical, MANPRINT, logistical, and cost requirements to meet the operational need.

4. User Functional Description (UFD) (Information Systems, and Materiel Systems with automated processing capabilities) (See Part VII). The UFD provides the bridge between the MNS and the detailed system specifications. It is prepared by the FP and defines the operational requirements in sufficient detail to guide the software development. The UFD describes implications of the operational requirements for automated capabilities on the system's operational modes and mission profile, proposed procedures, interfaces with other systems, and degraded operations.

5. Functional Description (FD) (Information Systems) (See AR 25-3). The FD is prepared by the PM/MATDEV after the development of the UFD. The FD provides detailed requirements to be used in the development of the system specifications. It reflects the definition of the system requirements and provides the users with a detailed statement of the required operational capability. It also describes the technical requirements needed of the system to achieve the operational requirements prescribed in the UFD. For materiel systems with a UFD, the ORD, rather than the FD, is the next product in the requirements generation process.

6. Economic Analysis (EA) (Information Systems) (See DOD 7920-2.M, AR 25-1). The EA is conducted to identify and quantify costs and benefits for program alternatives. It considers such factors as productivity, availability, efficiency, safety, quality, morale, security, and supportability.

Figure 2-1.

7. Critical Operational Issues and Criteria (COIC). (See Part Three). The primary purpose of COIC is to focus and support the MS III production decision. They reduce the multitude of operational considerations to a few operationally significant and relevant issues and criteria. COIC reflect the minimum operationally effective and suitable system expectation for an affirmative production decision; however, they are not to be treated as automatic pass/fail absolutes. The total operational system must satisfy the criteria (or convincing other evidence of operationally effective and suitable system presented) for an affirmative production decision. Secondarily, COIC focus and prioritize the operational evaluation, provide operational priority for the acquisition effort, and foster coordination among the acquisition team members. COIC are not test issues and can be answered using any suitable data source and evaluation technique. The operational evaluator must report system status against the COIC for the production decision. The total operational system includes the materiel, combat, software and training developer portions. COIC apply to all new materiel acquisitions (ACAT I through IV), class II through V IMA systems, and applicable modifications to these systems.

8. Cost and operational effectiveness analysis/cost and training effectiveness analysis (COEA/CTEA) (Materiel Systems) (See DoDI 5000.2, DOD 5000.2-M, and AR 71-9). The COEA and CTEA provide information on system costs and operational and training effectiveness to evaluate the merits of alternatives. The COEA is prepared for the MS I and MS II decision reviews and also update as required for the MS III decision review. The MS I COEA is used to narrow the list of alternatives to the most preferred. The MS II COEA contains a more detailed analysis to determine relative cost and effectiveness of each alternative assessed in the demonstration and validation phase. The criteria and specifications which define the minimum performance characteristics are to be traceable to the MNS and the ORD.

Figure 2-1.

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PROGRAM MANAGEMENT ELEMENTS

1. Acquisition strategy (AS) (See AR 70-1 and AR 25-3). The AS provides a broad, conceptual framework for the execution of an acquisition program. It states the concepts and objectives that direct and control overall development, production, and deployment. An AS is required for all Army acquisition programs. The AS documents how the acquisition program will be tailored and identifies risks and plans to reduce or eliminate the risks. The AS and the TEMP are developed in parallel to ensure that the documents are mutually supporting. The AS, prepared by the MATDEV in coordination with the acquisition team, is a living document that matures throughout the system's life cycle. By MS I for both materiel and information systems, it covers 10 functional areas including T&E, MANPRINT, supportability, technical risks, manufacturing and production, cost growth and drivers, human factors engineering (HFE), safety and health, rationalization, standardization, and interoperability (RSI), survivability and endurance, and electrical power and environmental equipment. The AS is approved by the appropriate decision review body either as a stand-alone document or as an element of the IPS (for materiel systems) or the SDP (for information systems).

2. Decision review bodies: Defense Acquisition Board (DAB), Army Systems Acquisition Review Council (ASARC), In-process Review Panel (IPR) (See DODD 5000.1, AR 70-1). Major management decisions during the acquisition process are made at milestones by review bodies. The type of review body depends on whether the acquisition has been categorized as an ACAT I, II, III, IV, or MAISRC. For the three program management levels, the review bodies are the DAB, the ASARC, and the IPR Panel. For ACAT ID and OSD MAISRC programs, the DAB reviews the critical issues and provides the SECDEF with recommendations. For ACAT IC and ACAT II programs, the ASARC provides the Secretary of the Army with recommendations on the system; and similarly for Army MAISRC programs. For nonmajor programs, the IPR Panel provides recommendations to the program executive officer (PEO) or MATDEV.

Figure 2-2. Program Management Elements

3. Project Management Plan (PMP) (Information Systems) (See AR 25-3). The PMP is the primary document used by the PM/MATDEV to describe the development of the information system. The PMP implements the PM's strategy and assigns responsibility to each participating agency, including testers and evaluators, and directs a course of action and method of execution for system development.

4. System Decision Paper (SDP) (Information Systems) (See AR 25-3). The SDP is the primary management document to support an information system through its milestone reviews. It summarizes the project, the alternatives considered, progress toward completion of the project, and the issues. It is required for all class II through V information systems. The SDP contains the AS and the PMP, and also includes the EA and TEMP as annexes.

5. Integrated Program Summary (IPS) (Materiel Systems) (See DODI 5000.2, DOD 5000.2-M, AR 70-1). The IPS provides a detailed summary of the program. The IPS provides a succinct integrated pictureof the program's status for use by the decision review body. The IPS is supplemented by attachments displaying summaries of system acquisition costs and manpower requirements.

6. Integrated Program Assessment (IPA) (Materiel Systems) (See DODI 5000.2, AR 70-1) The IPA summarizes the results of the independent assessments conducted by the support staff and decision review forums. The IPA is a major issue oriented document. The IPA provides an independent assessment of a program's status and readiness to proceed into the next phase of the acquisition cycle.

Figure 2-2.

Figure 2-2. Program Management Elements

7. Agency Procurement Request (APR) (Information Systems) (See AR 25-3). The APR is prepared by the PM/MATDEV or contracting activity in order to obtain delegation of procurement authority from the General Services Administration for most information systems exceeding certain monetary thresholds. These thresholds should not be confused with those which define the information system classes.

8. Request for Proposal (RFP) (See DODI 5000.2). The RFP is developed by the MATDEV based on milestone decision reviews and the AS. Specifications in the RFPs are to be traceable to the MNS, ORD, COIC, and other requirement documentation. The developmental and operational evaluators are to ensure that adequate numbers of test items will be available for testing; that there are no unacceptable test limitations driven by the RFP; and that provisions are made in the RFP to provide appropriate contractor test data to the independent evaluators

9. Preliminary and Critical Design Reviews, and Physical Configuration Audits (PDR/CDR/PCA) (MIL-STD-1521B, MIL-STD-2167). Technical reviews and audits provide a valuable source of data for developing test plans. The PDR, CDR, and PCA are periodic reviews of the detailed design, contractor testing, and operation and support documents for the system under development. In addition, they provide data useful in the evaluation of design compatibility between the system and other systems in the field. A Physical Configuration Audit (PCA) is a technical review of a system prototype to verify that the end item (as built) conforms to the technical documentation which defined the system. After successful completion of the PCA, all subsequent system changes are processed by Engineering Change Actions.

Figure 2-2.

Figure 2-2. Program Management Elements

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Chapter 3
Roles and Missions in Test and Evaluation

3-1. Introduction

a. Coordination among all participants of the DoD and Army Test and Evaluation community is essential to the success of the Development and Operational Test and Evaluation processes in the acquisition of Army systems and continuing evaluation of thathose systems after acquisition. A fully coordinated and integrated effort is necessary for timely, effective, and efficient T&E that is neither fragmented nor redundant. The respective roles and missions of the organizations within the DoD that play a role in the T&E of Army systems are identified in this chapter.

b. The functional interactions among organizations of the Army T&E community (figure 3-1) manage and supervise the T&E process, accomplish the T&E, and provide support for T&E. Many of the organizations in the T&E community perform multiple functions in the T&E process.

c. All of the organizations in the T&E community use and review the output of T&E to enhance the Materiel Acquisition Process (MAP) and the Information Mission Area (IMA) acquisition process and their contributions to the T&E process. The T&E community forms work groups to perform specific planning and coordinating functions for T&E and to participate in decision making bodies such as the Defense Acquisition Board (DAB), the Army Systems Acquisition Review Council (ASARC), Major Army Information Systems Acquisition Review Council (MAISRC), and the In Process Review (IPR) panel. These groups oversee progress in the acqusition processes, make recommendations on selection of program alternatives, and recommend whether programs should proceed to the next acquisition phase.

(insert figure 3-1)

Section I
Department Of Defense Activities

3-2. The Under Secretary of Defense for Acquisition (USD(A))

a. Exercises the responsibilities and authorities in DoD Directive 5134.1, Under Secretary of Defense (Acquisition) and DoD Directive 5000.49, Defense Acquisition Board.

b. Establishes and publishes acquisition management policies and procedures that supplement and implement the provisions of

DoD Directive 5000.1, Defense Acquisition.

c. Prepares long-range acquisition investment area analyses and, coordinates the funding of concept direction studies.

3-3. Director, Test and Evaluation/Live Fire Test (D,T&E/LFT)

a. Serves as the principal staff assistant and advisor to the Under Secretary of Defense for Acquisition for technical expertise, oversight and support to all elements of the DoD acquisition system.

b. Approves (in conjunction with DOT&E) TEMPs of all ACAT I and OSD T&E oversight programs.

c. Monitors the conduct and reporting of DT&E for ACAT I programs and other systems selected for oversight.

d. Confirms that nuclear hardness and survivability objectives are achieved during DT&E.

e. Oversees the live fire test program.

f. Chairs the Defense T&E Steering Group (DTESG)

g. Manages the Foreign Weapon Evaluation Program.

h. Manages the Joint T&E Program.

i. Establishes and maintains Data Exchange Agreements with foreign nations.

j. Plans and approves investments in test and evaluation resources and threat simulators.

k. Establishes and maintains DoD policies and instructions for the Developmental T&E (DT&E).

l. Establishes and maintains standard procedures for conducting T&E for selected types of weapon systems.

m. Manages the DoD Major Range and Test Facility Base.

n. Oversees the Defense T&E Professional Institute.

o. Provides the independent OSD report of Live Fire Test and Evaluation to Congress on covered ACAT I and II programs and system modifications prior to the decision to proceed beyond

LRIP.

3-4. Director of Operational Test and Evaluation (DOT&E)

a. Reports directly to SECDEF. The Office of DOT&E is independent from the Under Secretary of Defense for Research and Engineering (USDRE), the USD(A), and all other offices in DOD responsible for research and development. The specific duties of DOT&E are outlined in DODD 5141.2.

b. Approves the acceptability of T&E plans (TEP), including the adequacy of funding and resources, of operational testing and evaluation of ACAT I, OSD level MAISRC IMA, and DOT&E oversight ACAT II, III, and IV programs. (See DODD 5141.2).

c. Reports to SECDEF and Congress on the adequacy of T&E and whether the results confirm the system's operational effectiveness and suitability in support of a final decision to proceed with a major program beyond low-rate initial production (LRIP).

d. Prescribes policies and procedures governing the conduct of operational test and evaluation.

e. Provides independent assessments and reports as required by current statutes.

f. Issues DOD Instructions to implement policies for OT&E.

g. Obtains reports, information, advice, and assistance as necessary to carry out assigned functions. DOT&E has access to all records and authenticated data in the DOD, including all DOD components.

h. Approves (in conjunction with D,T&E/LFT) Test and Evaluation Master Plans (TEMPs) for acquisition of ACAT I, OSD level MAISRC IMA, and OSD designated T&E oversight programs (ACAT II, III, and IV systems). Written approval is required before operational testing may begin.

i. Observes preparation and conduct of OT&E.

j. Prepares annual OT&E report to Congress (including Army OT&E).

k. Serves as advisor to the Defense T&E Steering Group (DTESG).

3-5. Service Component Operational Test Activities (OTA)
The head of each Military Department and, as appropriate, Defense Agency have established an independent operational test and evaluation activity (See figure 3-2 and DODD 5000.1). These activities:

a. Are separate and independent from the materiel-developing and procuring agency, and the using agency.

b. Are responsible for planning and conducting operational tests, reporting results, and providing evaluations of each tested system's operational effectiveness and suitability.

c. Report directly to the head of the DOD Component, except that the Secretary of a Military Department may delegate responsibility for supervising this activity to the Service Chief concerned.

3-6. Defense Information Systems Agency (DISA)

a. DISA is responsible for operational test and evaluation of strategic IMA systems for which no Lead Military Department or equivalent has been assigned.

b. The Joint Tactical Communications Agency's (JTC3A), Joint Interoperability Test Center (JITC) is the DISA's responsible operational test agency (OTA). JITC will conduct operational test and evaluation in a mission and threat environment as operationally realistic as possible, in accordance with DoD Directive 5000.2. In this capacity, the Director, JTC3A is the independent test agency for all DISA acquired C3I systems.

3-7. Defense Test and Evaluation Steering Group (DTESG)
DTESG advises on the DoD corporate direction and guidance for the management of defense T&E resources, including those for operational T&E. It consists of senior members and advisors from D,T&E/LFT, DOT&E, Army, Navy, Air Force, Defense Nuclear Agency, Strategic Defense Initiative Organization, from the Science and Technology Community, and the Chairman of the Joint Commanders Group for Test and Evaluation (JCG(T&E)).

a. Formulates DoD corporate planning and programming guidance for T&E resources, including threat simulators, and simulations.

b. Conducts reviews of DoD T&E business management practices; the execution of directed T&E investment programs, projected and actual workloads, and test program utilization of test facilities.

c. Formulates initiatives that streamline and improve the productivity and effectiveness of test and evaluation resource management and the conduct of test and evaluation.

3-8. Joint Commanders Group for Test and Evaluation (JCG(T&E))
The JCG(T&E) advises the Joint Logistics Commanders on issues and opportunities of common interest to avoid duplication of efforts in all matters of operational and developmental test and evaluation operations and resources. Also manage the DoD-wide T&E Community Network (TECNET).

3-9. Multi-Service Test Investment Review Committee (MSTIRC)
The MSTIRC advises the JCG(T&E) on operational and developmental T&E investments (including threat simulators, and modeling and simulations) needed by DoD, and recommends strategies to obtain them while avoiding duplication and promoting inter-service reliance.

3-10. Defense Modeling and Simulation Organization (DMSO)
The DMSO promulgates policies to facilitate DoD-wide applications of modeling and simulations, including for test and evaluation. Also, implements programs for joint Service modeling and simulation improvements and investments.

Section II
Headquarters, Department Of Army Activities

3-11. Army Acquisition Executive (AAE)
The AAE has:

a. Authority, responsibility, and accountability for all acquisition functions and programs within the Army as provided for in DODD 5000.1 and, for enforcing the procedures established by the Under Secretary of Defense for Acquisition.

b. Authority to review and provide assessment of any changes reported in individual major defense acquisition programs, the significance of problems reported by the Program Manager, the Program Manager's proposed action plans, and the level of risk associated with such plans.

c. Serves as principal advisor in the Army on all matters relating to acquisition management to include resource allocation decisions.

d. Participates in the selection and evaluation of Program Executive Officers (PEOs) and Program Managers (PMs) for major defense acquisition programs.

e. For ACAT ID programs, approves the Army position prior to the DAB. For ACATs IC and II, serves as the MDA. For ACAT III and IV, assigns the MDA.

3-12. Deputy Under Secretary of the Army for Operations Research (DUSA(OR))
The DUSA(OR) is an element of the Army Secretariat and is the principal advisor to the Secretary of the Army for matters concerning Army T&E.

a. Establishes, reviews, and supervises Army T&E policy and procedures.

b. Provides oversight of all Army T&E associated with the system research, development and acquisition as well as those associated with doctrine, training, force design, leader development, and materiel requirements programs.

c. Approves all T&E documents requiring OSD review:

(1) TEMPs and TEPs for HQDA prior to submission to OSD.

(2) Monitors the T&E program for the Army.

d. Provides staff management of all user test programs of interest to the Office of the Secretary of the Army (OSA).

3-13. Assistant Secretary of the Army for Research, Development, and Acquisition (ASARDA)
The ASA(RDA):

a. Serves as a member of the Test Schedule and Review Committee (TSARC). (See AR 15-38.)

b. Plans, programs and budgets RDTE and Other Procurement, Army (OPA) funds for test and evaluation, in support of test programs.

c. Supports test requirements, scheduling, and funding to provide adequate items or systems for test.

3-14. The Deputy Chief of Staff for Operations and Plans (DCSOPS)
The DCSOPS:

a. Plans, programs, and budgets Operations and Maintenance, Army (OMA) T&E funds for OPTEC and for the conduct of FDTE and FOTE.

b. Participates in the TSARC process. (See AR 15-38.)

c. Reviews, coordinates, and approves requirements and COIC for ACAT I, II, OSD T&E oversight ACAT III and IV programs, and theater/tactical MAISRC information systems.

d. Serves as HQDA point of contact and oversight for OSD chartered Joint Test and Evaluation (JT&E). Managing, soliciting, and coordinating Army participation in JT&E tests. Providing Army members to the JT&E Planning Committee and JT&E Senior Advisory Council. Providing Army liaison to OSD on JT&E issues.

e. Approves requirements for Instrumentation, Targets, and Threat Simulators (ITTS) as chartered by the ITTS General Officer Steering Committee.

f. Manages and monitors funding of Army Threat Simulator Program (ATSP), Army Targets Program (ATP), Army Instrumentation Program (AIP), and interfaces with PM ITTS.

g. Establishes and chairs Test and Analysis Integration Working Groups (TAIGs) to execute VV&A of models and simulations in support of test and evaluation.

3-15. The Deputy Chief of Staff for Logistics (DCSLOG)
The DCSLOG has primary Army General Staff responsibility for integrated logistics support (ILS) and related T&E policy to include input to program management documents. (See AR 750-1 and AR 700-127.) The DCSLOG participates in the TSARC process as required. The DCSLOG is the Functional Proponent (FP) for some sustaining base IMA systems. As the FP, DCSLOG develops, coordinates, and obtains approval of COIC, signs as the user representative on TEMP cover page before submission to DUSA(OR) for approval, provides Test Support Packages (TSP) for operational test and otherwise is the user representative. (NOTE: When an IMA system is both sustaining base and Theater/Tactical, the combat developer accomplishes these COIC and TEMP functions).

3-16. The Deputy Chief of Staff for Personnel (DCSPER)
The DCSPER has primary Army General Staff responsibility for:

a. Manpower, Personnel, Training, Human Factors Engineering, Health Hazards and System Safety (MANPRINT).

b. Ensuring that MANPRINT T&E concerns are addressed in appropriate testing and T&E documents.

c. Participating in the TSARC process. (See AR 15-38.)

3-17. The Deputy Chief of Staff for Intelligence (DCSINT)
DCSINT has responsibility for:

a. Providing guidance on representation of threat in testing.

b. Establishing threat policy and procedures and approval of the threat to be used for test and evaluation.

3-18. The Director of Information Systems for Command, Control, Communications and Computers (DISC4)
The DISC4:

a. Manages IMA activities in support of the Army Acquisition Executive (AAE), to include T&E IMA life cycle management.

b. Plans, programs and budgets Operations and Maintenance, Army (OMA) funds for fixed and recurring costs for T&E conducted by U.S. Army Information Systems Command (USAISC).

c. Approves COIC for classes 2 through 5 startegic and sustaining base IMA systems. Establishes Army procedural guidance for developement, coordination, and approval of COIC for these systems. Assists the Deputy Chief of Staff for Operations and Plans in reviewing, coordinating, and approving requirements and COIC for theater/tactical information systems.

d. Assigns operational test and evaluation (OT&E) responsibilities for non-MAISRC level information systems through the IMA Architectural Control Committee.

e. Designates the OT&E responsibilities for strategic information systems when the Army is assigned as the lead military department. Designation will be in coordination with the Defense Communications Agency (DCA) and OPTEC.

f. Assists the DUSA(OR) in developing IMA-related test policy.

3-19. The Surgeon General (TSG)
The TSG:

a. Provides support to testers and evaluators concerning health hazards.

b. Authorizes the use of humans as volunteers for test and evaluation.

c. Performs health hazard assessments.

d. Reviews or participates in preparation of safety releases as required.

e. Serves as a program sponsor for tests of medical materiel.

f. Participates in the TSARC as required. (See AR 15-38.)

3-20. The Chief of Engineers (COE)
The COE:

a. Provides support to program sponsors in development of materiel for operation in extreme climatic conditions.

b. Provides policy, guidance, and support of tests and evaluations with regard to the subject of environmental effects on Army materiel and operations.

c. Executes the test aspects of those commercial items of equipment procured for use in engineer maintenance and supply activities.

d. Reviews digital terrain data for accurate representation in demonstrations and tests.

e. Acts as program sponsor for COE acquisition programs.

f. Participates in the TSARC as required. (See AR 15-38.)

g. COE (Washington, DC, and Fort Belvoir, VA) is both a proponent for engineer materiel acquisition and a designated OT activity. COE executes tests of commercial engineer equipment and monitors the OT and CE programs for engineering impacts. Testing of military developmental engineering equipment is accomplished by OPTEC.

3-21. Director, Test and Evaluation Management Agency (TEMA)
TEMA, Office of the Chief of Staff, Army, reports operationally to the DUSA(OR), and is responsible to:

a. Develop and monitor Army developmental and operational test policy.

b. Coordinate all test and evaluation policy and resource actions with Office, Assistant Secretary of the Army (Research, Development and Acquisition), (OASA(RDA)), other HQDA agencies, OSD, Chief of Naval Operations, (CNO), Headquarters US Air Force

(HQ USAF), U.S. Army Operational Test and Evaluation Command (USAOPTEC), U.S. Army Materiel Command (USAAMC), U.S. Army Training and Doctrine Command (USATRADOC), U.S. Army Strategic Defense Command (USASDC), U.S. Army Information Systems Command (USAISC), U.S. Army Health Services Command (USAHSC) and U.S. Army Intelligence and Security Command (INSCOM).

c. Manage the HQDA staffing and approval process for TEMPs requiring HQDA and OSD approval.

d. Oversee development, update and accreditation of test and evaluation related models and simulations.

e. Coordinate and facilitate communications with OSD on test and evaluation matters.

f. Develop and monitor Army Major Range and Test Facility Base MRTFB) management and funding policy.

g. Coordinate and oversee T&E funding for investment Research, Development, Test and Evaluation (RDTE) and Other Procurement, Army (OPA) accounts and user test support.

h. Oversee development of T&E personnel strategy plans for identifying and training individuals.

i. Oversee Army Joint T&E and multiservice test programs.

j. Serves as Army representative to the Department of Defense (DOD) Executive Committee for threat simulators and targets.

Section III
U.S. Army Operational Test and Evaluation Command (OPTEC)

3-22. OPTEC General
DODD 5000.1 requires that the DOD Components maintain OTA's that are separate from the development and using commands and report directly to the heads of the respective services. The Army's primary independent operational T&E activity is OPTEC. As stated in AR 73-1, the Commanding General, OPTEC, supports the MAP, IMA acquisition process, and force development process through overall management and support of the Army's OT and CE programs. OPTEC's key contribution to the MAP and IMA acquisition process is the testing and independent evaluation of the actual and projected effectiveness and suitability of developing materiel and IMA systems. The OPTEC mission is stated in detail in AR 10-88, 4 April 1990.

a. Reporting channels. OPTEC is a field operating agency of CSA. OPTEC reports through VCSA to CSA; coordinates closely with the MATDEV and CBTDEV communities; and ensures that the HQDA, MATDEV, CBTDEV, and logisticians are informed of the operational condition of each system in the acquisition process. The Commanding General, OPTEC, is the chairman of the Test Schedule and Review Committee (TSARC) and a member of ASARC or the IPR panel for each system. OPTEC may communicate and coordinate directly with any DOD or U.S. Government activity to obtain information or assistance in support of its mission.

b. Continuous Evaluation (CE) functions. A major aspect of OPTEC's mission is conduct of the Army's CE program (see chap 3). Throughout the MAP, CE uses data from all available sources to provide decision makers with evaluations of current and projected system status. Sources of data for the CE process include contractor tests, DT, OT, FDTE, modeling, simulations, analyses, prior system-related T&E, combat, and any other available information. CE functions include:

(1) Support the development of CE policy and methodology.

(2) Evaluating programs designated for CE continuously from program initiation through postfielding deployment, as required.

(3) Performing an abbreviated evaluation on non-major ACAT III and IV programs, except those designated for full-evaluation.

(4) Periodically evaluating for the materiel acquisition decision makers the effectiveness of the systems undergoing CE, describing corrective actions and identifying tests that will verify operational effectiveness and suitability after corrective actions have been completed.

(5) Evaluating current and projected effectiveness of supporting program elements.

c. Operational testing program functions. OPTEC is the manager of the Army's Operational Test (OT) program (AR 73-1). OT includes FDTE, CEP, CT, EUTE, LUT, IOTE, FOTE, onsite operational tests, joint operational tests and evaluations (JOTE) and, multi-service operational tests and evaluations (MOTE) (See chapter 12). OPTEC manages OT by:

(1) Developing and promulgating OT&E policy and methodology.

(2) Preparing the OT&E portion of the TEMP for all OPTEC evaluated systems, and performing overall quality assurance of

content and compliance with format of the entire TEMP.

(3) Informing the acquisition decision maker when acquisition strategies preclude adequate OT&E from being accomplished.

(4) Ensuring that OT&E conducted by other Army OT&E activities is effectively planned, conducted, and reported.

(5) Developing and staffing the Army position on OT&E matters, plans, and reports for submission to OSD and Congress.

(6) Recommending the conduct of FDTE to the TRADOC when such testing is needed to support the development and evaluation of of the readiness of TRADOC doctrine, training, leadership development, and orgranizational products for the system prior Initial Operational Test (IOT) for ACAT I, II and other acquisition programs.

(7) Publishing the Five-Year Test Program (FYTP) after the TSARC coordination and DCSOPS approval.

(8) Supporting OSD-directed Joint Operational Testing and Evaluation (JOTE) and MOTE by providing the Army point of contact, developing and staffing the Army position on joint test documentation, and coordinating Army resource support, as required.

(9) Managing the Army User Testing Instrumentation Program in coordination with TSARC.

(10) Planning, programming, and budgeting to accomplish OPTEC's OTE management functions.

d. Responsible for maintaining a long range plan for operational T&E resource requirements.

e. OPTEC is the Army's primary independent operational tester and evaluator, with the exception of those specialized systems assigned to the U.S. Army Health Services Command (USAHSC) for medical materiel, U.S. Army Intelligence and Security Command (USAINSCOM), and Corps of Engineers (COE). OPTEC manages the Operational Test Program and operational testing performed by other organizations, and coordinates the overall OT&E process.

3-23. OPTEC Operational Evaluation Command (OEC)
The Operational Evaluation Command is under OPTEC and supports the Army Acquisition process by managing OPTEC's Continuous Evaluation Program to ensure timely, complete, and independent

operational evaluations.

a. Conducts full independent operational evaluations for:

(1) ACAT I and II programs.

(2) ACAT III and IV programs designated for DOT&E oversight or selected for full evaluation by HQDA or Commander, OPTEC.

(3) ACAT III and IV programs which may require evaluation based upon program cost, system complexity, procurement risk, doctrinal change, relationships with other systems, or requirements for data beyond operational test as determined by Commander, OPTEC.

(4) Selected IMA MAISRC systems.

b. Conducts abbreviated operational evaluation for:

(1) All other ACAT III and IV programs supported by a TEXCOM Test and Evaluation Report (TER) on results of operational tests or by sources such as simulations, modeling, market surveys, combat, training exercises, or developmental testing.

(2) IMA MAISRC systems and selected non-MAISRC IMA systems where evaluation responsibility has been delegated to another Army activity.

c. Performs analyses on authenticated data (level 3 data) that has been approved by the Data Authentication Groups (DAG), and generates Level 4, 5, 6, and 7 data in support of operational and continuous evaluations.

d. Reviews and coordinates on Mission Need Statements (MNS), and Operational Requirements Documents (ORDs).

e. Works with CBTDEV and FP during their development of Critical Operational Issues and Criteria (COIC), and develops and approves Additional Operational Issues and Criteria (AOIC).

f. Develops evaluation concepts, including identifying measures of effectiveness (MOEs) - levels 5,6 or 7 data; measures of performance (MOPs) - level 4 data; data elements required; and performs design of experiments or tests for obtaining required data to perform evaluations.

g. Responsible for the operational model-test-model program, including developing and executing Verification, Validation, and

Accreditation Plans for the use of modeling and simulation in OT&E. Recommends accreditation of models and simulations to Hq OPTEC.

h. Participates in Test Integration Working Groups (TIWG) (See Section 3-54).

i. Participates in Test and Analysis Integration Groups (TAIGs) see Section 3-51.

j. Chairs Operational RAM Scoring Conferences for operational evaluations, and the RAM Assessment Conference - see Section 3-57. Coordinates on Failure Definition/Scoring Criteria.

k. Provides inputs to the PM for exit criteria for Milestones I and II, LRIP release, as well as for other specific operational T&E events.

l. Prepare inputs for Operational Test Plan for resources to support the TSARC.

m. Establishes and reports on progress for meeting entrance criteria for entering an OT&E or CE event at Operational Test Readiness Reviews.

n. Publishes operational assessments, independent evaluation reports, and operational test and evaluation reports.

o. Performs quality control for DA on overall TEMPs as well as prepares Part 4.

p. Prepares Chapters 1 and 2 of the TEP, and integrates overall document.

q. Chairs System Task Forces to coordinate all test, evaluation and analysis disciplines (eg, MANPRINT, RAM, software, and performance) required to support OT&E or CE for a particular system or program.

3-24. OPTEC Test and Experimentation Command (TEXCOM)
TEXCOM is under OPTEC and supports the Army materiel acquisition and force development processes by executing the user testing program by conducting operational testing to support CE and force development. All TEXCOM elements are responsible for continuous improvement of processes for the purpose of optimizing resources and improving products. TEXCOM is responsible for the following:

a. Plans, conducts, collects data and reports the results of

operational tests, special studies, commercial equipment evaluations, customer tests, and field experiments. Remains prepared to conduct quick response tests involving safety and improvements to operational readiness of fielded units. Types of tests conducted include, but are not limited to EUTE, CT, LUT, FDTE, CEP, IOTE, and FOTE.

b. Conducts comprehensive programs for developing and improving test methodology, test instrumentation, test facilities, and ranges to support the testing mission. Develops and monitors contract specifications and technical specifications for procurement packages.

c. Provides data collection training and maintains individual soldier skills to Army standards.

d. Provides direction to subordinate elements in the management of test and experimentation programs. Supervises test team formulation and manages formatting, coordination, and processing for TSARC approval of resource requirements and documentation for each test assigned.

e. Reviews and comments on test aspects of test-related documents to include mission need statements, operational requirements documents, test and evaluation plans, resume sheets, and test support packages) that are received from proponent schools, independent evaluators, and materiel developers.

f. Maintains close and continuous coordination with combat developers in regard to the development and testing of tactics, doctrine, training, organization and material.

g. Consults and coordinates with other DOD armed services, allied nations armed services, industry, and test sponsors on the test mission programs and scientific and technical aspects of materiel testing and experimentation.

h. Performs special projects and staff actions and supports the operations of HQDA, OPTEC, and DOD in test-related areas. Provides membership or representation on boards, panels, committees, councils, working groups, symposia, and conferences as approved by the Commander, TEXCOM.

i. Provides advice to proponent agencies and materiel developers during the development of equipment which is either used by or provides support to Army units.

j. Coordinates and assists in submission of environmental

impact statements for tests. Responsible for implementation of Hazardous Waste Management Plan and protection of historical properties.

k. Participates in Test Integration Working Groups (TWIGS) as operational tester.

l. Conducts tests for TRADOC schools and centers.

m. Ensures that combined arms skills, doctrine, and training are being integrated into operational testing.

n. TEXCOM Experimentation Center (TEC). A subordinate center of TEXCOM, located at Fort Hunter Liggett, CA, conducts scientific, highly instrumented field experimentation and collects high-resolution, accurate data in an operational environment.

o. Participates as a member of the System Task Forces.

3-25. OPTEC Operational Threat Support Activity (OTSA)
OTSA a subordinate element of OPTEC, is located at Fort Bliss, Texas and assists and advises the Commander, OPTEC in the fulfillment of the OPTEC assigned responsibility for Army Threat Simulator (ATS) Program actions. Operates and maintains operating replica simulators and actual threat systems and ensures that realistic threat environments are used in support of free-play, force-on-force, real-time casualty assessment testing and training. Responsible for continuous improvement of processes for the purpose of optimizing resources and improving products.

3-26. OPTEC Test and Evaluation Coordination Offices (TECO)
TECOs are subordinate elements of OPTEC and provide on-site coordination between OPTEC and the TRADOC Proponent Center. Provide operational test and evaluation (T&E) expertise to the TRADOC proponent activity. The TECO is responsible for continuous improvement of processes for the purpose of optimizing resources and improving products. TECOs are located at Fort Rucker, AL, Fort Knox, KY, Fort Leonard Wood, MO, Fort Benning, GA, Fort Lee, VA and Fort Gordon, GA.

3-27. Other Operational Testers
In general, TEXCOM accomplishes operational testing for ACAT I, II, III and IV and selected IMA programs for the Army. Other agencies conduct specialized operational testing in the areas of communications, intelligence (INSCOM), medical materiel (USAHSC), new technology, and commercial engineer equipment (CEE). For

assigned systems the designated operational testers:

a. Participate in development of issues and criteria.

b. Identify CBTDEV provided issues to be addressed in OT&E.

c. Plan program and budget, conduct, and report on OT&E to support the materiel acquisition decision review process.

d. Assist in preparation of the OT&E portion of the TEMP.

e. Prepare test plans and reports and coordinate with OPTEC and TEXCOM as appropriate.

Section IV
U.S. Army Training and Doctrine Command (TRADOC)

3-28. TRQDOC General
TRADOC is the Army's principal doctrine developer, combat developer, training developer, and trainer. As such TRADOC:

a. Establishes the operational concepts and doctrine for field Army operations on the future battlefields.

b. Analyzes and projects the future threat in coordination with other appropriate Army and DOD organizations.

c. Defines Army organizational, leader development, training, and materiel operational requirements.

d. Represents the user during all aspects of requirement definition, system acquisition, and force development.

e. Conducts individual and collective training as well as leader development programs for soldiers.

3-29. HQ TRADOC

a. Plans, programs, budgets, and executes the Concept Evaluation Program (CEP) and the Force Development Test and Experimentation (FDTE) program in support of above.

b. Conducts Concept Evaluation Schedule and Review Committee (CEPSARC) to coordinate, prioritize, and approve projects for execution in the CEP Program.

c. Represents TRADOC during TSARC processes (includes: impacting test resource requirements on TRADOC, approving and

prioritizing the proposed FDTE projects for execution, participating and concurring in the prioritization of other operational tests, and participating in resolution of other issues).

d. Provides procedural guidance for execution of the TRADOC T&E function.

e. Approves Critical Operational Issues and Criteria (COIC) for TRADOC proponent ACAT I and II, OSD level Theater/Tactical MAISRC IMA, and OSD/DA T&E Oversight systems. Forwards those applicable to Milestone (MS) I TEMP to the PM for inclusion in the TEMP. Forwards those for MS II and system modification TEMP updates to HQDA for ADCSOPS-FD approval.

f. Signs TEMP cover page as user representative reviewer for TRADOC proponent ACAT I and II, OSD Theater/Tactical IMA, and OSD/DA T&E Oversight systems.

g. Provides member to the ATEC.

h. Approves Training TSP for TRADOC proponent ACAT I through IV materiel and Classes 1 through 5 Theater/Tactical/IMA systems.

i. Performs staff supervision of TRADOC T&E operations.

j. Approves requests for waiver of operational tests and forwards through OPTEC to the decision authority for approval.

3-30. TRADOC Proponent Commands, Centers, Schools and Battle Labs

a. For systems in acquisition (particularly ACAT I and II materiel systems, Theater/Tactical MAISRC systems and OSD T&E oversight systems, define the Force Development Evaluation (FDEV) strategy (including requirements for CEP and FDTE) to support TRADOC products development, maturation, and verification prior initial operational test.

b. Serves as operational evaluator for proponent TRADOC product FDEV projects (includes definition of applicable operational issues and criteria, writing chapters 1 and 2 of TEP when required (e.g., mutiple-source evaluations always and CEP almost never (chapter one provided in resume sheet) conducting the evaluation, and reporting the evaluation).

c. Develops Resume Sheet (RS) for identified CEP requirements in coordination with the TECO or TEXCOM (when necessary) and

submits to HQ TRADOC for project approval and prioritization.

d. Requests designation of tester by OPTEC for those FDTE not addressed in a TEMP (must be accompanied by a draft TEP chapter 1).

e. Develops COIC for all assigned proponent materiel and IMA systems in acquisition and, when applicable, modifications to these systems. Approves those for ACAT III and IV materiel systems as well as non-MAISRC IMA system not on the OSD T&E oversight list. Forwards to HQ TRADOC for approval COIC for ACAT I and II materiel systems, Theater/Tactical MAISRC systems, and other OSD/DA T&E oversight systems.

f. Prepares and delivers to the operational tester Doctrine and Organization Test Support Packages (D&O TSP), Threat TSP, and Training TSP. Approves D&O TSP. Forwards Threat TSP for ACAT I, II, and OSD T&E oversight systems to THRU CAC to DA (DCSINT) for approval. Approves Threat TSP for ACAT III and IV systems not on the OSD T&E oversight list. Forwards Training TSP to HQ TRADOC for approval. Provides the appropriate Operational Test Readiness Statement (OTRS with each TSP.

g. Prepares and presents COIC-ORD Crosswalk briefing to ADCSOPS-FD for COIC approval.

h. Serves as the principal Combat Developer, Training Developer, and Trainer member to the TIWG, RAM Scoring Conference, RAM Assessment Conference, Data Authentication Group (DAG), and Operational Test Readiness Review (OTRR).

i. Conducts (or over sees conduct of) player training (individual, collective, and unit training for operational testing. Certifies players trained and ready for operational test.

k. Submit requests for waiver of approved TEMP identified operational tests to HQ TRADOC for approval and forwarding through OPTEC to the decision authority for approval.

l. Utilize CEPs to identify high pay-off technology and force development initiative early and concentrate resources on concepts with the greatest potential.

3-31. TRADOC Analysis Command (TRAC)

TRAC (Fort Leavenworth, KS) coordinates TRADOC centers and activities concerned with research and analysis. The analyses, modeling, and research performed by TRAC and its subordinate

activities may indicate issues or estimate outcomes useful in operational evaluation.

Section V
U.S. Army Materiel Command (USAMC)

3-32. USAMC General

AMC is the Army's principal MATDEV. Its functions include research, development, configuration management, DT&E, production T&E, establishment of a common-use T&E database, ILS planning and execution, RAM, acquisition and procurement, production, product assurance, safety and health considerations, human factors engineering (HFE), security, and new equipment training (NET) of materiel systems.

a. Specific AMC functions in support of DT&E.

(1) Support the development and promulgation of DT&E policy.

(2) Plan, coordinate, and provide functional support to PEOs and PMs, and execute the responsibilities of a PM for assigned systems.

(3) Develop system threat assessment reports after MS I and Threat System Support Packages for developmental testing.

(4) Plan for, develop, and provide specific test items and support materiel to conduct required required testing.

(5) Include the impact of DT&E in the system's environmental assessment (EA) and environmental impact statement (EIS) (AR 200-2 and AR 70-1). Ensure that the developmental tester is informed of any adverse environmental impacts associated with equipment operation.

(6) Include funds for DT&E in plans, programs, and budgets.

(7) Provide test ranges and facilities as approved in the FYTP to support testing.

(8) Provide a system that is ready for DT&E. Develop exit criteria for each milestone and T&E event.

(9) Provide a member to the ATEC and the TSARC.

b. Specific AMC functions in support of OT&E.

(1) Monitor and support OT&E and CE.

(2) Develop and provide for the OT&E agency a NET support package (NETSP), system support package (SSP), OTRSs, and system safety releases (SRs), as required.

(3) Include the impact of OT&E in the system's environmental assessment (EA) and environmental impact statement (EIS) (AR 200-2 and AR 70-1). Ensure that the operational tester is informed of any adverse environmental impacts associated with operational use.

(5) Include funds for OT&E in plans, programs, and budgets.

(6) Provide DT data to the OT&E agency and arrange for OT&E agency participation in DT to support OT and CE objectives.

(7) Provide test ranges and facilities as approved in the FYTP to support OT&E and CE.

(8) Provide a system that is ready for OT&E. Develop exit criteria for each milestone and special operational T&E event.

3-33. AMC Commodity Commands
Six of the ten MSCs of AMC are the commodity commands, which are the life cycle managers for the materiel in their commodity areas. Life cycle management includes research and development, procurement, logistic support, rebuild direction, and disposal. Several commands operate arsenals and plants with manufacturing and production capabilities. The commodity commands are:

a. Armament Munitions and Chemical Command (AMCCOM).

b. Aviation and Troop Command (ATCOM).

c. Communications-Electronics Command (CECOM).

d. Missile Command (MICOM).

e. Tank-Automotive Command (TACOM).

f. Simulations, Training, and Instrumentation Command (STRICOM).

3-34. U.S. Army Test and Evaluation Command (TECOM)

a. Developmental testing functions. As the Army's principal developmental tester for weapons and equipment, TECOM performs the following DT functions:

(1) Planning, executing, and reporting the results of DT of Army materiel for each acquisition program. DT includes early research tests, engineering development tests, TFTs, PPQTs, PQTs, joint development tests (JDTs), and contractor and foreign tests (non-Government testing agreed to and integrated into the TEMP to provide data for technical evaluation purposes). TECOM also conducts post-production testing, e.g., stockpile reliability and reconditioning tests (AR 73-1).

(2) Providing test facilities for the conduct of DT.

(3) Serving as a member of the TIWG to provide technical expertise in support of the T&E life cycle.

(4) Maintaining the Army's Major Range and Test Facility Base (except for Kwajalein Missile Range).

(5) Providing Safety Releases to testers prior to any tesing using soldiers as test players (except for systems developed by ISC, HSC, SDC, and MRDC) (AR 385-16).

(6) Providing safety confirmations in support of the decision review (AR 385-16).

(7) Researching, developing, and acquiring test instrumentation; developing and acquiring advanced test technologies such as artificial intelligence, robotics, directed energy, and space test procedures; and developing new and improved test methodology to increase the efficiency, validity, and reliability of DT.

b. Independent development assessor functions. In addition, TECOM performs the following functions as AMC's developmental assessor for ACAT III and IV programs:

(1) Planning, performing, and reporting CE of Army materiel for each acquisition program. Developmental evaluation addresses the system's technical parameters and the acquisition and fielding of an effective, supportable, and safe system. It does this by assisting in engineering design and development; verifying the adequacy of the technical data package and the attainment of technical performance specifications, objectives, producibility, and supportability; and determining safety, health hazards, human factors, and MANPRINT aspects. Developmental evaluations encompass the use of models, simulations, and testbeds, as well as prototypes or full-scale development models.

(2) Assisting the developers by providing information about

technical performance; qualification of components; compatibility, interoperability, vulnerability, transportability, and survivability; RAM; MANPRINT; system safety; ILS; correction of deficiencies; accuracy of environmental documentation; and refinement of requirements.

(3) Confirming readiness for OT by ensuring that the system is stressed to at least the levels expected in the OT environment.

(4) Determining that the system is technically operable in the required climatic and realistic battlefield environments, including natural, induced, and countermeasure environments.

(5) Providing a representative to TIWGs and a voting member to RAM S/A conferences.

c. Other major testing functions.
They design, conduct, and assess developmental tests. TECOM testing may identify issues for consideration in operational testing. TECOM data and reports make significant contributions to CE. TECOM's system safety activities are of vital importance to the T&E community, because no testing involving troops may begin until the system is certified safe for use under the conditions or limitations specified in the SR issued by TECOM. TECOM also provides a bridge to the early activities of the MAP through the advanced test technology interfaces. TECOM has the largest and most complete assemblage of testing technology assets in the Army, including procedures, instrumentation and equipment, and skilled scientists. HQ TECOM is located at Aberdeen Proving Ground, MD. In addition, TECOM has nine major DT activities around the country. For additional information on the capabilities of these test activities, see Part Four, Section XXI.

(1) Aviation Technical Test Center (ATTC), AL. ATTC does aviation testing of fixed wing and rotary wing aircraft, aircraft components, and related ground support equipment.

(2) Cold Regions Test Center (CRTC). CRTC is the cold region environmental test center for the Army, testing all commodities of Army systems.

(3) Combat Systems Test Activity (CSTA), Aberdeen Proving Ground, MD. CSTA is a multipurpose proving ground where most major commodities are tested including vehicles, munitions, weapons, general equipment, and CIE. Test facilities include firing ranges, complex vehicle test courses, a radar tracking

site facility, and many special laboratories.

(4) Dugway Proving Ground (DPG), UT. DPG has the full range of capabilities for testing chemical agents and chemical and biological defensive systems and equipment. Facilities also include a remote test site in Panama to test the full range of Army systems, clothing and individiual equipment for effects of operationa and long-term exposure in natural tropical environments.

(5) Electronics Proving Ground (EPG), AZ. EPG is a highly specialized proving ground for electronics-oriented testing. Research is also performed in image technology, image interpretation, radar applications, antennae, and other fields related to communications and electronics.

(6) Jefferson Proving Ground (JPG), IN. JPG is the Army's volume-production-level ammunition acceptance test facility capable of supporting wartime production. It has a 5-mile firing front with 125 firing sites and a 20,000-meter range.

(7) White Sands Missile Range (WSMR), NM. WSMR performs DT of Army missile systems, air defense fire distribution systems, space systems, surface-to-surface missile systems, and other weapon systems.

(8) Yuma Proving Ground (YPG), AZ. YPG is a multipurpose proving ground specializing in testing of long-range artillery, aircraft armament systems, air delivery systems, and in-desert environmental testing. YPG operates an air-to-ground and ground-to-ground aircraft armament test range with electronic and optical real-time instrumentation.

(9) Redstone Technical Test Center (RTTC), AL. RTTC tests small rockets and guided missiles. Facilities are also available for testing of electro-optical devices under simulated battle-field countermeasures and obscurants.

3-35. U.S. Army Materiel System Analysis Activity (AMSAA)
AMSAA is a systems analysis and modeling activity reporting to AMC.

a. As the independent developmental evaluator for Army materiel systems, AMSAA's responsibilities include participating in the CE process by performing the following:

(1) Reviews T&E Master plans for adequacy, and prepares the developmental T&E portion of the T&E Master Plan (TEMP) in

conjunction with the developmental tester.

(2) Prepares Independent Evaluation Plans (IEP) for DT.

(3) Prepares overall DT Test Design Plans (TDP).

(4) Participates in the development of Failure Definition and Scoring Criteria (FD/SC).

(5) Participates in TIWGs.

(6) Voting member in Scoring Conferences for DT and OT.

(7) Participates in RAM Assessment Conferences.

(8) Analyzes and evaluates DT test data.

(9) Conducts risk analyses.

(10) Performs independent DT evaluations, and publishes Independent Evaluation Reports (IERs).

(11) Participates in OT&E DAGs.

(12) Presents technical status/risk assessments at OTRRs.

(13) Develops exit criteria for a weapon system to be certified as ready for OT&E.

(14) Develops the system reliability growth curve for the system LCC.

b. As the Army's independent logistician, AMSAA:

(1) Performs the ILS program surveillance for Army materiel systems.

(2) Performs ILS assessments.

(3) Evaluates all materiel acquisition programs and deployed systems, except for medical items,

(4) Monitors tests on an exception basis.

3-36. Army Research Laboratory (ARL)
The ARL is a new organization within AMC which consists of the seven laboratories which made up the former Army LABCOM. It combines the laboratories with additional selected technical base

activities from other organizations within the Army. ARL will eventually consolidate all its elements into two locations in MD with a site for large scale experiments and outdoor assessments in NM. ARL is a world-class laboratory established to conduct basic and applied research, exploratory development and analyses with the critical mass, synergy, and flexibility to satisfy the Army's future technological needs in sensors, signatures, signal and information processing; electronics and power sources; battlefield environments; vehicle propulsion; materials; vehicle structures; weapons technology; human research and engineering; advanced computing and software; and survivability/lethality and MANPRINT analyses. With emphasis on teamwork and partnership with industry and academia, ARL seeks out all available resources in the Army's pursuit to give our soldiers a technological advantage.

Section VI
Other HQDA Activities

3-37. Information Systems Command (ISC)
ISC (Fort Huachuca, AZ) participates in the acquisition process and, as designated by HQDA, conducts DT and OT for systems applicable to ISC's mission. Primary focus is on communications, electronic, and automatic data processing (ADP) equipment. Specific responsibilities are in AR 10-87 and AR 73-1. As a CBTDEV, ISC establishes materiel development objectives and requirements. As a tester, ISC conducts DT and OT and evaluations of communications equipment developed for use in the following:

a. Defense Communications System (DCS), Army.

b. Installation level communications.

c. Air traffic control systems.

d. Other communications as specifically designated by HQDA.

3-38. Intelligence and Security Command (INSCOM)
INSCOM (Fort Belvoir, VA) conducts DT&E and OT&E for assigned classified or secured systems (See AR 10-87 and AR 73-1). Assesses the functionality and interoperability of INSCOM mission systems (as opposed to communications systems that ISC is responsible for). INSCOM is the CBTDEV for strategic SIGINT systems and represents DCSINT on study advisory groups (SAGs), special task forces (STFs), and special study groups (SSGs). Specifically, INSCOM:

a. Establishes materiel development objectives and requirements.

b. Conducts DT and OT of SIGINT equipment for use in the National SIGINT System (Army) as specifically designated by HQDA.

c. Is responsible for the overall design of SIGINT systems that have sole application to the SIGINT System.

d. Coordinates with the Commanding General, AMC, on matters related to acquiring SIGINT systems for which INSCOM has been designated the MATDEV.

3-39. Health Services Command (HSC)
HSC (Fort Sam Houston, TX) performs OT&E of medical materiel (AR 40-60). Specific responsibilities are in AR 10-87 and AR 73-1. Through the HSC subordinate element, the Academy of Health Sciences, HSC is the medical materiel CBTDEV, trainer, user tester, and user representative. Specifically, HSC:

a. Conducts OT&E of medical equipment as directed by ODCSOPS.

b. Conducts medical materiel combat development activities.

c. Reviews and evaluates CBTDEV's documents to determine potential health hazards related to nonmedical materiel under development.

d. Provides technical assistance to the MATDEV by evaluating health hazards related to operating materiel systems.

e. Prepares health hazard assessment reports to TSG.

3-40. U.S. Army Forces Command (FORSCOM)
FORSCOM is the primary source of user troops for OT, and also provides troops for DT, when required. Because FORSCOM is the ultimate user of new materiel, its participation in T&E is essential throughout the MAP. In the program initiation phase, FORSCOM ensures that its interests as the ultimate user of the equipment are considered during MAAs. Throughout the MAP, FORSCOM refines requirements for user troops. During the production and deployment phase, FORSCOM provides user comments, usage data, and requests for product improvement.

3-41. Concepts Analysis Agency (CAA)
CAA is a field operating agency that reports to the Director of the Army Staff, Office of the Chief of Staff, Army (OCSA). Its mission is to conduct analyses of Army systems in the context of

joint or combined forces. These analyses establish the context for lower-level systems and may establish Issues and Criteria useful in OT&E. CAA provides data from force design or requirement studies and formulates performance data requirements for FDTE. CAA contributes to the CE program through its modeling, simulation, and studies efforts. CAA's functions and responsibilities are detailed in AR 10-38.

3-42. Logistics Evaluation Agency (LEA)
LEA is a field operating agency of ODCSLOG. The Commander, USALEA will assist OPTEC with evaluation or assessment of IMA logistics systems under MAISRC control which are processed on selected tactical computer systems.

Section VII
Program Sponsors

3-43. Program Executive Officer (PEO) (See AR 70-1, AR 25-3.)
The PEOs review and provide their assessment of any changes reported in assigned individual programs, the significance of problems reported by the Program Manager, the Program Manager's proposed action plans, and the level of risk associated with such plans. The PEO can be the program sponsor as well as the MATDEV. The PEO is responsible for the following:

a. Administer a defined number of assigned major and nonmajor programs, as approved by the AAE, ensuring that all Army agencies are responsive to the needs of the PM in achieving programmatic goals.

b. Charter, supervise and evaluate assigned program, project, and product managers and provide the planning guidance, direction, control, oversight, and support necessary to field systems within cost, schedule, and performance baselines.

c. Provide technical, operational, and functional integration across assigned programs. Ensure that functional (matrixes) support to subordinate PMs is planned and coordinated with the supporting organizations.

3-44. Program Managers

a. Program Managers. The actual manager of a specific acquisition or development program at its inception, normally referred to as PM, Product Manager, or Project Manager ensures the planning, coordination, and support of the T&E activities of the specific program by:

(1) Providing assessments of program status and risk in all briefings and presentations to higher authorities, actively manage contract performance, and provide assessment of contractor performance.

(2) Preparing, coordinating, distributing, and maintaining the TEMP.

(3) Establishing and chairing a Test Integration Working Group (TIWG) to effect T&E coordination and solve routine problems. Substantive issues which cannot be resolved by the TIWG will be surfaced through the chain of command for resolution.

(4) Providing the testers and evaluators the opportunity to participate in the preparation of the testing portion of the Request for Proposal (RFP) to assure that T&E requirements are accurately reflected in contractual documents. Changes occurring during the contract negotiations which affect testing will be communicated to the TIWG. The TEMP will be updated to reflect those changes.

(5) Conducting Development Test Readiness Reviews (DTRR), and preparing a Development Test Readiness Statement (DTRS) verifying that the system is ready for the Preproduction Qualification Test (PPQT) for materiel systems, or the Software Qualification Test (SQT) for ISs.

(6) Providing formal certification (via an Operational Test Readiness Statement (OTRS) that the system is ready for operational test. Upon request from the user, providing formal certification that the system, to include brassboards in the development stage, is ready for use in the Force Development Test and Experimentation (FDTE).

(7) Assuring that DT&E of all systems are conducted in representative environments to include testing in natural environments.

(8) Establishing, documenting, and providing the system support package (SSP) and new equipment training support package.

(9) Considering use of U.S. Army Materiel Command (USAAMC), Test and Evaluation Command (TECOM) test facilities before establishing in-house capabilities or contracting for testing services. It is recognized that there will be instances when TECOM test facilities cannot accommodate testing or scheduling requirements, or when other compelling reasons exist that would

make use of TECOM facilities impractical. These exceptions should be documented in the TEMP and be coordinated with TECOM, the TIWG and TEMP approval authorities.

(10) Determining (in coordination with the TIWG) the degree to which LFT&E will be conducted for designated systems.

(11) Participating in assigned TAIGs.

b. Programs. PM managed programs are categorized as executive and non-executive.

(1) An executive program is managed by a PM who is subordinate to a PEO or a PM reporting directly to the AAE. All major systems and Army high interest programs will be executive.

(2) A non-executive program is managed by a PM subordinate to any other materiel developer (e.g., U.S. Army Materiel Command, US Army Corps of Engineers, U.S. Army Medical Research and Development Command, U.S. Army Information Systems Command.)

c. The requirement for all PMs will be established by the AAE. The executive PMs will be chartered by and report directly to PEOs.

3-45. PM Training Devices (PM TRADE)
The PM TRADE (STRICOM) is the advisor and independent program assessor for all training device developments. Systems developers will coordinate the development of training devices with the PM TRADE before proceeding. (See AR 350-38).

3-46. PM Instrumentation, Targets and Threat Simulators (PM ITTS)
PM ITTS (STRICOM) has responsibility for oversight of all operational test instrumentation programs, to include both major and sustaining instrumentation. PM ITTS also coordinates with OPTEC to address operational testing requirements.

Section VIII
Review Fora

3-47. Defense Acquisition Board (DAB)
The DAB is the primary forum for resolving issues and facilitating Under Secretary of Defense for Acquisition decisions for acquisition category I programs. In support of the Defense Acquisition Board, the appropriate Committee of the Board will conduct a pre-Defense Acquisition Board review. The office of

the Secretary of Defense Cost Analysis Improvement Group and the Joint Requirements Oversight Council also support the Defense Acquisition Board in its review process. The DAB is chaired by the Under Secretary of Defense for Acquisition, and the Vice Chairman of the Joint Chiefs of Staff serves as vice chairman. A more detailed discussion on the DAB process and procedures is contained in DODI 5000.2, Part 13.

3-48. Army Systems Acquisition and Review Council (ASARC)
The ASARC is the Army's senior-level review body for ACAT I and II programs. The ASARC will be convened at formal milestones to determine a program or system's readiness to enter the next phase in the materiel acquisition cycle, and make recommendations to the AAE on those programs for which he/she is the MDA. An ASARC may also be convened at any time to review the program status. ACAT ID programs are subsequently reviewed by the DAB. It is co-chaired by AAE and VCSA. ASARC membership, functions and procedures are outlined in AR 70-1.

3-49. Major Automated Information System Review Council (MAISRC)

a. DoD MAISRC. The DoD MAISRC is chartered by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence under the overall guidance of DoD Directive 5000.1, Defense Acquisition, and operates in accordance with DoD Directive 7920.1, Life Cycle Management of Automated Information Systems and, DoD Instruction 7920.2, Automated Information Systems Life-Cycle Management Review and Milestone Approval Procedures. Automated Information Systems that meet the thresholds for acquisition category I programs are reviewed by the DAB.

b. Army MAISRC. Principal HQDA officials will participate in the Army MAISRC as required. The MAISRC recommends actions to SA for decision or subsequent recommendations to SECDEF. A MAISRC provides the Army position for DAB consideration for major systems. For Class I/II systems the MAISRC provides the SA with its recommendation on the system. MAISRC functions and procedures are outlined in DODI 7920.2 and AR 25-3. The appropriate MAISRC performs a formal review on systems subject to AR 25-3. The purpose of the review is for management to obtain a current status of the project and to provide additional guidance and/or give milestone approval to the project. All class II Iss also undergo a DOD MAISRC review unless the responsibility has been delegated to the Army. The criteria that determine whether a system requires formal HQDA review are in Chapter 2, AR 25-3. The review process prescribes a set of steps with specific documentation requirements. It provides detailed

procedures for conducting management reviews, describes the actions that must be completed prior to each review, and specifies the documentation necessary for approval of an IS designated for MAISRC review.

3-50. In-Process Review (IPR)
The IPR is the review forum for all ACAT III and IV programs and is chaired by the Milestone Decision Authority (MDA). General policies for reviews of IPR programs are the same as for ACAT I and II programs. Reviews are conducted at formal milestones and at other times deemed necessary by the MDA. IPR members include the MATDEV, CBTDEV, independent operational and technical evaluator, logistician, trainer (if different from the CBTDEV), functional support organization or staff and others, as determined by the IPR Chair. For selected IPR tests, OPTEC monitors OT&E by reviewing and commenting on test documentation. OPTEC may either send a panel member to present the results of OT evaluations directly to the IPR panel or forward a written Operational Assessment/ Abbreviated Operational Assessment (OA/AOA). IPR functions are covered in AR 70-1.

3-51. Materiel Release Review Board (MRRB)
Materiel release policy is stated in AR 700-142, Materiel Release, Fielding, and Transfer. The testers and evaluators inform the MATDEV, CBTDEV, and other ILS program participants of potential materiel release, fielding, or transfer problems and recommend solutions to the problems. The independent evaluators prepare operational assessments or test and evaluation reports (TER), that present a position relative to proposed materiel releases. The TERs address the ability of the system to fulfill the requirements in the approved requirements documents and specifications. Materiel release prerequisites must be met before materiel release. To ensure that the objectives of the materiel release process are reached, the MATDEV will provide the logistician, CBTDEV, and other participants in the MRRB, a copy of the documentation showing that the materiel release prerequisites have been met.

3-52. Test Schedule and Review Committee (TSARC)
TSARC is the formal process through which Outline Test Plans (OTPs) are approved and included in the Five Year Test Program (FYTP). Established by CSA, the TSARC provides high-level centralized resource management by maximizing the use of limited resources and minimizing the impact on unit operational readiness (AR 15-38). Commanding General, OPTEC, chairs the TSARC, prepares, coordinates, and presents proposed changes to the FYTP; and publishes the FYTP after ODCSOPS approval. OPTEC also develops policy guidance for conduct of TSARC. Commanding

General, AMC, and all operational testers other than OPTEC submit coordinated OTPs to the TSARC for inclusion in the FYTP.

a. Schedule. The TSARC cycle occurs semiannually from February to August and from September to December (see table 2-3 for approximate dates; TSARC establishes specific dates). OPTEC chairs follow-on DA working group TSARCs in May and October. DA General Officer TSARCs are held in April and December to consider issues not resolved during the DA working group TSARCs. The General Officer TSARC then recommends approval of OTPs for inclusion in the FYTP to ODCSOPS. Procedures for approving an OTP between scheduled TSARCs are in AR 15-38 and the TSARC Handbook.

b. Functions. The primary functions of the TSARC are to:

(1) Review and recommend coordinated OTP for inclusion in the FYTP.

(2) Review and recommend UT/TT priorities and resource support.

(3) Resolve conflicts between test requirements and other missions.

(4) Review and recommend approval of the FYTP.

3-53. Test Integration Working Group (TIWG)

a. Functions. A TIWG is chartered for acquisition systems in accordance with Draft AR 73-1, to coordinate and integrate T&E planning and participation by all parties. The TIWG supports CE by sharing data and doing continuing T&E documentation, planning and integration of T&E in the development and acquisition process. The TIWG does not alter the responsibilities or authority of any command or headquarters. In the event of disagreements, issues are resolved through normal command channels. A more detailed list of TIWG functions are in AR 73-XX, Chapter 6.

b. Establishment. The TIWG is established by the MATDEV upon program initiation (e.g., receipt of the acquisition decision memorandum (ADM) or approval of the MNS). It supports preparation of the TEMP and addresses the T&E aspects of the AS, RFP or contract, and other program management documents (AR 70-1). TIWG members are members of the Acquisition Team and remain a principal active working group throughout the MAP. TIWG members also coordinate on waivers of required testing.

c. Membership. Membership in the TIWG includes the; MATDEV (chair), CBTDEV, Technical tester, Technical evaluator, Operational tester, Operational evaluator, Logistician, Trainer,

(1) The Army Command Control System (ACCS) systems engineer or subsystem engineer for any ACCS component system or equipment that has one or more interfaces.

(2) The PM for smoke or obscurants for all systems that rely on electromagnetic propagation or are susceptible to aerosol countermeasures.

d. The associate members are:

(1) The Integrated Logistics Support Management Team (ILSMT).

(2) The contractor.

(3) Monitoring commands or activities (e.g., TSG's representative for health aspects associated with testing).

(4) Subcommands or activities of principal attendees.

e. Subgroups. At least the following subgroups are formed to support the TIWG:

(1) The RAM subgroup is chaired by the MATDEV and includes at least the CBTDEV and the independent technical and operational evaluators. The purpose of this subgroup is to address all RAM-related matters.

(2) The supportability T&E subgroup is chaired by the ILS manager of the MATDEV. The purpose of this subgroup is to provide coordination with the ILSMT. Topics to be coordinated include all supportability test issues, test requirements, transportability, and logistic demonstration requirements contained in the TEMP.

f. Other groups interfacing with the TIWG. The TIWG may interface with the following working groups during the life cycle of the system:

(1) RAM rationale report working group (RRRWG).

(2) Computer resources working group (CRWG).

(3) MANPRINT joint working group (MJWG).

(4) Technical test readiness review (TTRR) working group.

(5) OTRR working group.

(6) Data authentication group (DAG).

(7) Joint Tactical Communications, Command, and Control Agency.

(8) Threat Coordinating Group (TCG).

(9) Threat Accreditation Working Group (TAWG).

3-54. Test and Analysis Integration Group (TAIG)
A TAIG is required after MS 0 for all ACAT ID, IC, II, and III/IV DoD Oversight programs for which a Cost and Operational Effectiveness Analysis (COEA) is planned. HQDA DCSOPS will establish each TAIG and its membership. Its responsibilities include:

a. Plans linkage between ORD development, COEA study plan and Essential Elements of Analysis (EEA), and Critical Operational Issues and Criteria (COIC) development.

b. Ensures a credible crosswalk between the TEMP development the ORD, the COEA, the COIC, and the Additional Operational Issues and Criteria (AOIC) in the TEP.

c. When model-test-model (MTM) is required, the TAIG examines the plans for that effort, and recommends as necessary.

d. Through the materiel developer member of the TAIG, advises the TWIG to incorporate pertinent analyses into TWIG efforts.

3-55. Operational Test Readiness Review (OTRR)
OTRR's are conducted by the operational tester prior to each test to allow the tester an assessment of readiness to test the system. The purpose of the OTRR is to determine the readiness of the system, support packages, instrumentation, test planning, to support the OT. It includes identification of any problems which may impact the start or adequate execution of the test. The objective of the review is to determine if any changes are required in planning, resources, training, equipment, or timing to successfully proceed with the test. OTRR's are chaired by OPTEC or other OT&E activity. Principal attendees include the operational tester, operational evaluator, MATDEV, CBTDEV, TNGDEV, FORSCOM (or other activity providing player or OPFOR troops), logistician, technical tester, technical evaluators,

HQDA staff elements, host installation, and contractor. The primary OTRR is conducted prior to resource deployment to test site (T-60). Additional reviews are conducted as required. See Chapter 5 for detailed instructions on OTRR.

3-56. Special Task Force (STF) and Special Study Groups (SSG)
An STF or SSG is normally formed during the concept exploration phase and is convened to conduct analyses, ensure that all alternatives are included in the analyses, monitor experiments, or undertake other such tasks that may require a concentration of special expertise for a designated period of time. The SSG determines what developmental instrumentation technologies will be required to support both technical and operational testing. The STF is chartered by CSA under the General Staff supervision of ODCSOPS. The SSG is chartered and under the supervision of the Commanding General, TRADOC. The STF or SSG reviews the requirements stated in the MNS or Operational Requirements Document (ORD). The functions and procedures of the STF and SSG are in AR 71-9. ODCSOPS or TRADOC sends the final report of the STF or SSG to the proper commands and agencies. The final report may be used in the following:

a. Concept formulation package (CFP), including MNS (if developed) and COEA.

b. System concept paper (SCP).

c. Baseline cost estimate (BCE).

d. TEMP.

e. ILS plan.

f. Standardization and interoperability plan.

g. Threat support plan.

3-57. Concept Evaluation Program (CEP) Schedule and Review Council (CEPSARC)
The CEPSARC is a TRADOC operated and chaired council which meets at least annually to review and prioritize its CEP projects (both new submissions and previously approved) to recommend the CEP program to the Deputy Chief of Staff for Combat Developments (DCSC), TRADOC for approval to execute. Representatives include TRADOC HQ, Commands, Centers, Schools, and Battle Labs (CEP projects); OPTEC (ammunition and flying hour programs impace); FORSCOM (unit impace if any) and TEXCOM (test organization impact).

3-58. Army Test and Evaluation Committee (ATEC)

a. Providing a forum by means of which all elements of the Army T&E community, acting as a committee of the whole, may formulate recommendations to the Army senior leadership regarding T&E policy, T&E procedures, organization, and resources.

b. Undertaking studies and reviews of specific T&E matters such as, but not limited to, the test instrumentation program, development of automated test data retrieval systems, and quality assurance of T&E products (test plans, designs, etc.).

c. Coordinating the missions, functions, composition, responsibilities, and concept of operations of all T&E activities within the Army and interface with OSD.

d. The ATEC is responsible for senior level focus on, and centralized guidance to, the management and coordination for all major T&E policy and resource issues.

e. The ATEC is responsible for the following functions:

(1) Develop and review Army T&E policy and procedures.

(2) Review and approve Army T&E requirements and allocations of available resources across functional lines.

(3) Review, forecast and prioritize future Army T&E instrumentation requirements.

(4) Review and coordinate modernization of T&E facilities.

(5) Ensure proper coordination is effected between the T&E community and the PEOs such that requirements for T&E resources, unique to a specific program, are resourced by the PEO.

3-59. Big Three Meetings
A group consisting of the ADCSOPS-FD, TRADOC DCSCDD, and the OPTEC Commander. The TEMA Director, the OEC Commander, and the TEXCOM Commander sit as associate members. The group meets periodically to discuss problems and topics of interest in the area of user testing and its interface with combat and training developments.

3-60. OTA Commanders Conference
Consists of the OPTEC Commander, the Navy OPTEVOR Commander, the AFOTEC Commander, and the Marine Corps OTEA Commander. The DOT&E is often represented at meeting of this body. The group meets

twice a year to discuss topics of mutual interest relating to OT&E.

3-61. RAM Scoring and Assessment Conferences
Scoring and assessment (S/A) conferences are conducted during or immediately following testing to insure effective accounting of RAM test data for use in evaluation. The operational tester and operational evaluator attend all S/A conferences which address data intended to support effectiveness and suitability evaluations. Furthermore, the operational evaluator chairs the OT scoring and assessment conferences and makes final Army determinations at OT conferences when no majority exists. The MATDEV chairs DT scoring conferences, and the independent development evaluator decides final Army positions on scoring RAM for these tests. The goals of the RAM Assessment conference are to establish a common data base and to estimate the extent to which the system has met all RAM requirements. See AR 702-3 and Chapter 11 for details of RAM Scoring and Assessment Conferences.

3-62. Data Authentication Group (DAG)
The DAG is a team of independent experts with a broad spectrum of technical disciplines assembled for the purpose of assessing and monitoring data reduction, quality control, and the identification and analysis of anomalies in the system, instrumentation, and test data. The principal goal of a DAG is a validated data base that accurately reflects how a candidate system performed during test. See chapter 9 for details of DAG.

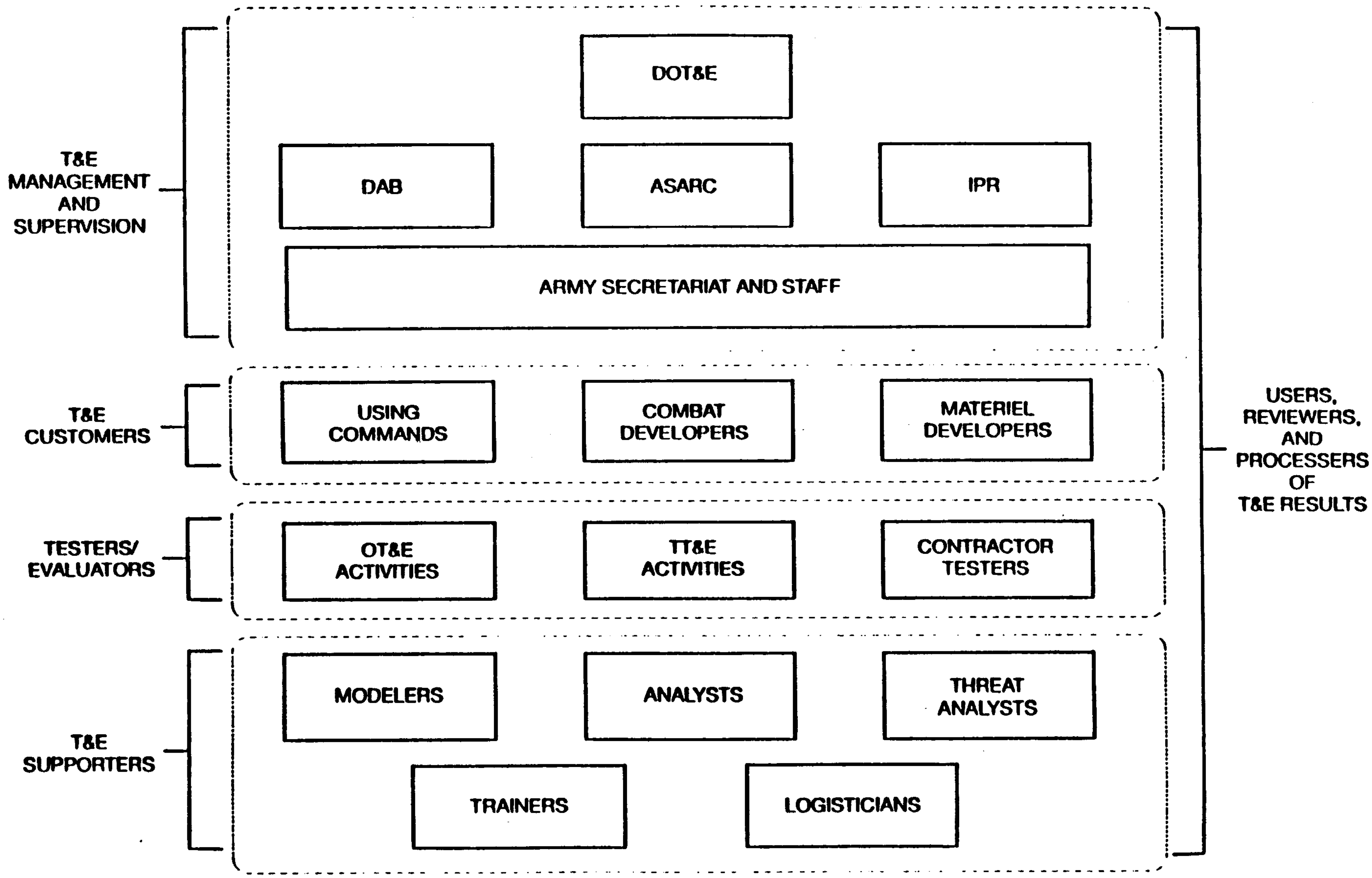

Figure 3-1. T&E community functional interactions.

Extract from DoD Directive 5000.1

Each military Department shall establish an independent operational test and evaluation activity. This activity shall:

-- Be separate and independent from the materiel-developing and materiel-procuring agency and the using agency.

-- Be responsible for planning and conducting operational tests, reporting results, and providing evaluations of each tested system's operational effectiveness and suitability.

-- Report directly to the Secretary of the Military Department who may delegate responsibility for supervising this activity to the Service Chief concerned.

Figure 3-2

Chapter 4
Test and Evaluation in Support of the Materiel Acquisition Process

Section I
Introduction

4-1. General

a. T&E is an essential activity in support of the Materiel Acquisition Process (MAP). It plays a key role in the life cycle of Army materiel systems, providing information that assists in selecting, acquiring, using, and disposing of Army materiel. T&E is inherent in the technology base activities that provide new technologies to be exploited; it is used to support the selection of best solutions to satisfy a mission area deficiency; it verifies that the Army is designing, developing, producing, and stockpiling materiel that satisfies the users' needs; and it assists in the assuring that materiel which is no longer usable can be disposed of safely.

b. Comprehensive developmental and operational testing shall be conducted on all materiel systems. Early detailed T&E planning is critical to meaningful evaluations and assessments, as well as to the successful development of the system. The T&E strategy shall specify the impact on risk of the technologies and processes selected for system development during the entire life cycle of the system.

c. Developmental T&E shall be planned and incorporated into the materiel system's development process to verify conformance to contract specifications and critical technical parameters in order to meet technical objectives and requirements. Developmental T&E shall encompass the system hardware, software, users manuals, training material, interfaces, compatibility, and interoperability with existing or planned systems. Operational T&E shall examine system effectiveness and suitability under operationally realistic conditions when the system is operated by typical users. In addition, the T&E should address the system's compatibility and interoperability with users and other systems.

d. Continuous evaluation (CE) as discussed in Chapter 2 is a major ingredient in the T&E which supports the MAP. It should begin as early as the battlefield functional mission area analysis and continue through the materiel system's postdeployment activities.

e. Detailed information concerning T&E of materiel systems is contained in Parts Four, Five, and Six. In addition, T&E of materiel software is contained in Part Seven. Roles and procedures for all elements of materiel software T&E, including the maintenance of software after deployment, are discussed.

f. The phases and milestones for the life-cycle system management model (LCSMM) for materiel systems is illustrated in figure 4-1.

(INSERT FIGURE 4-1 HERE)

Section II
T&E Activities During Determination of Mission Needs

4-2. Determination of Mission Need Activities

All acquisition programs are based on the identification of mission needs. A mission need may be to establish a new operational capability or to improve an existing capability. If a mission need cannot be satisfied by a nonmateriel solution (i.e., changes in doctrine, operational concepts, tactics, training, and organization), then a Mission Need Statement (MNS) is developed. The MNS is a broad statement of mission need, expressed in terms of an operational capability rather than a system-specific solution. This phase ends at Milestone 0 (MS 0), which formally approves the MNS.

a. Key Events. In this phase, the Combat Developer (CBTDEV) determines whether a mission deficiency or an opportunity to improve an existing system is important enough to warrant further analysis and development of a system. The CBTDEV ensures that proper planning and evaluation are successfully carried out. Key activities associated with the determination of mission needs process are depicted in figure 4-2.

(INSERT FIGURE 4-2 HERE)

b. T&E Activities. T&E activities during this phase usually involve the evaluation of nonmateriel solutions to satisfy an identified mission need. The CBTDEV, with the assistance of the independent operational evaluator, may execute a Concept Evaluation Program (CEP) to aid in this evaluation. The CEP can provide the CBTDEV with a quick reaction and simplified process to examine and resolve combat development, doctrinal, and training issues. Within a CEP, tests may be executed to provide experimental databases for an MNS and subsequent requirements

documents. In addition, a Force Development, Test, and Experiment (FDTE) may be conducted to support the development of concepts and doctrine, training, and organizations not specifically tied to a materiel system acquisition (See Part Five).

c. Continuous Evaluation Activities. The CBTDEV, with assistance from the independent operational evaluator, should evaluate the merits of a nonmateriel solution to satisfy an identified mission need. If CEP tests or FDTEs are conducted, test reports are to be written and provided to the CBTDEV. The CBTDEV should also assist in the development of any exit criteria that may be presented at MS I.

4-3. Milestone 0 T&E Requirements
The MNS must be developed and submitted to the milestone decision authority for approval.

Section III
T&E Activities During the Concept Exploration and Definition Phase (Phase 0)

4-4. Phase 0 Activities
A successful MS 0 decision allows the program to advance into the Concept Exploration and Development Phase (Phase 0). Approval at MS 0 allows for the study of alternative concepts to meet the need identified in the MNS. Phase 0 explores various materiel alternatives in satisfying the documented mission need.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 4-3.

(INSERT FIGURE 4-3 HERE)

b. T&E Activities. T&E planning will formally begin in this phase. Appropriate T&E shall be accomplished and documented in test and evaluation reports and the TEMP to assist in selecting the preferred alternative system concept, associated technologies, and designs. In particular, the use of modeling and simulation is encouraged in this phase to aid in the assessment of alternatives (See Chapter 16). T&E will provide data for concept evaluation of a potential requirement, tactics, doctrine, organization, training, transportability, and logistic support for the preferred system concept; identify and assess high risk areas, critical components and subsystems; establish safety for operational testing; and assess the operational impact

of the preferred concept. Figure 4-4 illustrates the typical T&E planning, execution, and reporting activities conducted during this phase.

(1) Planning.

(a) The TIWG shall be established and chaired by the PM (if established), or by the appropriate acquisition team until a PM has been established, and shall be established upon receipt of the approved MNS (See Chapter 8). A draft Operational Requirements Document (ORD) will be prepared and used with the System Threat Assessment Report (STAR) to assist in developing and finalizing the initial COIC (See Part Three), and preliminary TEMP (See Part Two). The TIWG will also contribute to the T&E portions of the AS, the RFP and other supporting documentation for decision authority approval at MS I. Special efforts should be made by the TIWG membership to characterize the realistic environment of the proposed system, including organizational structures, skill levels, manpower requirements, threat, mobility and deployability requirements, climatic extremes, electromagnetic environmental effects, and concepts of operation and maintenance. The acquisition team members, or PM (if designated), will also coordinate with the testers and independent evaluators to optimize the use of existing TECOM test facilities and initiate necessary test technology activities.

(b) Developmental and operational testing will be planned to provide data to support evaluations of the system in its intended environment. As early as possible in this phase, the independent developmental evaluator or assessor shall develop an Independent Evaluation Plan (IEP) (or Independent Assessment Plan (IAP)) to support the developmental evaluation of the proposed system during this phase. Typical developmental tests include technical feasibility tests, which assist in determining safety and the establishment of proposed system performance specifications. Developmental Test Design Plans (TDPs) will be developed for these tests by the independent developmental evaluator, and Detailed Test Plans (DTPs) will be developed for these tests by the independent developmental tester (See Part Four). Typical operational tests may include CEP tests and FDTEs (See Part Five).

(2) Execution. Technical feasibility tests, CEP tests, and FDTEs shall be executed by the appropriate independent testers in accordance with the approved test plans.

(3) Reporting. After each developmental test, a test report (TR) shall be written by the independent developmental

tester and provided to the independent developmental evaluator or assessor for inclusion in the Independent Evaluation Report (IER) or Independent Assessment Report (IAR). The independent operational tester shall prepare TRs for each CEP test and FDTE. An Early Operational Assessment (EOA) or Abbreviated Operational Assessment (AOA) may be used by the independent operational evaluator to provide a status of the system in support of MS I (See Parts Four and Five).

(INSERT FIGURE 4-4 HERE)

c. Continuous Evaluation Activities. Figure 4-5 contains the CE activities to be conducted during this phase (See Parts Four and Five).

(INSERT FIGURE 4-5 HERE)

4-5. Milestone I T&E Requirements
Figure 4-6 contains the T&E requirements to support MS I.

(INSERT FIGURE 4-6 HERE)

Section IV
T&E Activities During the Demonstration and Validation Phase (Phase I)

4-6. Phase I Activities
Approval at MS I establishes a new acquisition program and Concept Baseline, and authorizes entry into the Demonstration and Validation Phase (Phase I). The key objective of Phase I is to demonstrate that the technologies critical to the most promising concept can be incorporated into the system design.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 4-7.

(INSERT FIGURE 4-7 HERE)

b. T&E Activities. T&E conducted in this phase includes prototyping, testing, and early operational assessments of critical systems, subsystems, and components. Developmental T&E will assist in the identification and reduction of design risk and indicate the degree to which new or emerging technologies pose a risk to the program. Operational T&E will assess the degree to which the selected design approach will operate in the intended operational environment. Appropriate T&E shall be

accomplished and documented in test and evaluation reports and the TEMP. The use of modeling and simulation is strongly recommended in this phase to aid in the assessments (See Chapter 16). T&E will also be conducted to address doctrine, training, organization, leader development, materiel requirements and logistics support aspects of the system using surrogate systems if necessary. T&E shall produce information with which to establish realistic program performance and suitability thresholds. Figure 4-8 illustrates the typical T&E planning, execution, and reporting activities conducted during this phase.

(1) Planning.

(a) The TIWG should be expanded as necessary to include the appropriate subgroups, and interfaces with other working groups should be established (See Chapter 8). In particular, the Live Fire Test and Evaluation Working Group (LFTEWG) is an example of a key working with which the TIWG must interface during this time. TIWG meetings should be held often, preferably prior to the execution of each test to ensure that test details are integrated and problems resolved. The update of the COIC and TEMP to support MS II can be conducted during these TIWGs, or at specially designated TIWGs (See Parts Two and Three). The ORD and STAR will be updated, and shall be used by the TIWG in the updating of the COIC and TEMP. The TIWG can assist in the update of such other documents as the System MANPRINT Management Plan (SMMP) and the Integrated Logistic Support Plan (ILSP). The TIWG will continue to contribute to the T&E portions of the AS, the RFP and other supporting documentation for decision authority approval at MS II. Sufficient funds will be programmed early by the program manager to ensure that adequate prototypes and ancillary equipment and components (i.e.; training devices, ground support equipment, physical structures, ammunition to test systems, field maintenance test sets, targets, simulators, stimulators, models and instrumentation) are available and adequately tested. Outline Test Plans (OTPs) must be developed and participation in the Test Schedule and Review Committee (TSARC) is required if the planned testing requires user troops and resources (See AR 15-38).

(b) Developmental and operational testing will be planned to provide data to support evaluations of the system in its intended environment. As early as possible in this phase, the existing developmental IEP or IAP should be updated to reflect information resulting from Phase 0 T&E activities and the MS I decision review. Typical developmental tests include engineering development tests (EDTs), which provide data on safety, the achievability of critical technical parameters,

refinement and ruggedization of hardware configurations, and determination of technical risks. TDPs will be developed for these tests by the independent developmental evaluator, and DTPs will be developed for these tests by the independent developmental tester (See Part Four). Typical operational tests include Early User Test and Experiments (EUTEs) and, if necessary, FDTEs. Operational Test Readiness Reviews (OTRRs) and Operational Test Readiness Statements (OTRSs) are required prior to the start of each EUTE. The independent operational evaluator will develop a Test and Evaluation Plan (TEP) for each EUTE in this phase (See Part Five).

(2) Execution. EDTs, EUTEs, and FDTEs shall be executed by the appropriate independent testers in accordance with the approved test plans. All required support packages must be developed and in place before test execution (See Chapter 9).

(3) Reporting. After each developmental test, a test report (TR) shall be written by the independent developmental tester and provided to the independent developmental evaluator or assessor for inclusion in the Independent Evaluation Report (IER) or Independent Assessment Report (IAR). A TR will be written after the conduct of each EUTE and FDTE by the independent operational tester. An EOA, AOA, or Operational Assessment (OA) will be used by the independent operational evaluator to provide a status of the system in support of MS II (See Parts Four and Five). MS II decisions to commit funds for production long-lead items or low-rate initial production (LRIP) must be supported by an EOA, AOA, or OA.

(INSERT FIGURE 4-8 HERE)

c. Continuous Evaluation Activities. Figure 4-9 contains the CE activities to be conducted during this phase (See Parts Four and Five).

(INSERT FIGURE 4-9 HERE)

4-7. Milestone II T&E Requirements

Figure 4-10 contains the T&E requirements to support MS II.

(INSERT FIGURE 4-10 HERE)

Section V
T&E Activities During the Engineering and Manufacturing Development Phase (Phase II)

4-8. Phase II Activities
Approval at MS II authorizes entry into the Engineering and Manufacturing Development Phase (Phase II). The key objective of Phase II is to translate the design approach developed in Phase I into a stable, producible, and cost-effective design.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 4-11.

(INSERT FIGURE 4-11 HERE)

b. T&E Activities. During this phase, the system (including necessary training devices, threat simulators, test equipment, and computer resources) is engineered, integrated, tested, evaluated, and documented to assure that the system design is stable, the system meets contract specifications and technical parameters, is operationally effective and suitable in its operational environment, meets user requirements, and is ready for production. T&E is conducted on prototype, production-representative, or production systems. Both developmental and operational tests are conducted during this phase. Developmental testing ascertains whether engineering is complete (including design and maintenance engineering), identifies design problems and ascertains that solutions to these problems are in hand. It reduces design risks, supports the evaluation of the critical technical parameters, establishes contractual compliance, provides information for the type classification determination, and validates general and detailed specifications, standards, and drawings for use in production. Operational testing determines the degree to which the system is operationally effective and suitable. The system design must be sufficiently mature to provide adequate support packages for testing, and to ensure that the system tested is representative of the production system to enable valid assessments of the system which is expected to be produced. If a low-rate initial production (LRIP) decision was made at MS II, then this phase may see the delivery of production systems for use in the IOT. Figure 4-12 illustrates the typical T&E planning, executing, and reporting activities conducted in this phase.

(1) Planning.

(a) As this phase is the most test-intensive phase of the acquisition process, TIWGs should be held often, preferably prior to the execution of each test to ensure the test details are integrated and problems are resolved (See Chapter 8). If

necessary, updates of the ORD, STAR and COIC will support the TEMP update, which can be conducted during these TIWGs, or at a specially designated TIWG (See Parts Two and Three). The TIWG should assist in the update of such other documents as the System MANPRINT Management Plan (SMMP) and the Integrated Logistic Support Plan (ILSP), and contribute to the T&E portions of the AS and other supporting documentation for decision authority approval at MS III. Outline Test Plans (OTPs) must be developed and participation in the Test Schedule and Review Committee (TSARC) is required if the planned testing requires user troops and resources (See AR 15-38).

(b) Developmental and operational testing will be planned to provide data to support evaluations of the system in its intended environment. As early as possible in this phase, the existing developmental IEP or IAP should be updated to reflect information resulting from Phase I T&E activities and the MS II decision review. Typical developmental tests include production-proveout tests (PPTs), live-fire tests (for designated systems), logistics demonstrations, and the Preproduction Qualification Test (PPQT). TDPs will be developed for each test by the independent developmental evaluator or assessor, followed by the DTPs written by the developmental tester. Development Test Readiness Reviews (DTRRs) shall be conducted, and the PM shall formally certify via the Developmental Test Readiness Statement (DTRS) that the system is ready for the PPQT to be conducted (See Parts Four and Six). Typical operational tests include Limited User Tests (LUTs), the Initial Operational Test (IOT) (required for all systems), and the Follow-On Operational Test (FOT), if necessary. FDTEs may also be conducted in this phase. Except for FDTEs, the independent operational evaluator will develop a TEP for each operational test in this phase, and OTRRs and OTRSs are required prior to the start of each test. The Director, Operational Test and Evaluation (DOT&E), Office of the Secretary of Defense (OSD), will approve adequacy of IOT test plans for the OSD oversight systems prior to conduct of the test (See Part Five).

(2) Execution. The PPT can consist of a series of tests on less than system-level components, or on early prototypes of the complete system. These tests should be tailored to meet the needs of the specific program. The PPQT is the principal developmental test in this phase, serving as the final developmental test prior to the IOT. The IOT must be conducted on production or production-representative systems to support independent evaluation of the system's operational effectiveness and suitability. The system tested must be sufficiently representative of the expected production system to ensure that

T&E validity supports the production decision. (See Parts Four, Five, and Six).

(3) Reporting. After each developmental test, a test report (TR) shall be written by the independent developmental tester and provided to the independent developmental evaluator or assessor for inclusion in the IER or IAR. The independent operational tester will prepare a TR after conduct of the FDTE. A Test and Evaluation Report (TER) will be developed by the independent operational evaluator after conduct of the IOT and FOT (if necessary) to provide a status of the system in support of MS II. An OA will be used by the independent operational evaluator to report on system status at intermediate decision reviews, or where a particular test is ongoing and results are incomplete (See Parts Four, Five, and Six).

(INSERT FIGURE 4-12 HERE)

c. Continuous Evaluation Activities. Figure 4-13 contains the CE activities to be conducted during this phase (See Parts Four, Five, and Six).

(INSERT FIGURE 4-13 HERE)

4-9. Milestone III T&E Requirements
Figure 4-14 contains the T&E requirements to support MS III.

(INSERT FIGURE 4-14 HERE)

Section VI
T&E Activities During the Production and Deployment, and Operations and Support Phases (Phases III and IV)

4-10. Phase III and Phase IV Activities
A favorable MS III decision represented approval to build, deploy, and support the system, and authorizes entry into the Production and Deployment Phase (Phase III). The key objective of Phase III is to establish a stable, efficient production and support base, and achieve an operational capability for the system which satisfies the mission need. If it is determined that a major modification or upgrade is warranted as a result of T&E conducted in Phase III, a MS IV (Major Modification Approval) review will be held. Otherwise, Phase III transitions smoothly into the Operations and Support Phase (Phase IV) without an intervening milestone.

a. Key Acquisition Events. The key acquisition activities conducted during these phases are depicted in figure 4-15.

(INSERT FIGURE 4-15 HERE)

b. T&E Activities
T&E shall be an integral part of the acceptance and introduction of system changes to improve the system, react to new threats, and reduce life-cycle costs. Production qualification testing and follow-on operational testing will be conducted to confirm and monitor performance and quality and to verify the correction of deficiencies. These tests include testing on the complete system necessary to verify that requirements specified in technical data packages and production contracts for hardware or software are met. Production testing also provides a baseline for follow-on post production testing. Feedback of test data including sample data collection is required to assess the as-built quality of the production items and to determine the need to change test methodology, equipment and facilities. Figure 4-16 illustrates the typical T&E planning, executing, and reporting activities conducted in these phases.

(1) Planning. TIWG meetings should be held often, preferably prior to the execution of each test to ensure the test details are integrated and problems are resolved (See Chapter 8). Outline Test Plans (OTPs) must be developed and participation in the Test Schedule and Review Committee (TSARC) is required if the planned testing requires user troops and resources (See AR 15-38). Developmental and operational testing will be planned to provide data to support evaluations of the system in its intended environment. As early as possible in Phase III, the existing developmental IEP or IAP should be updated to reflect information resulting from Phase II T&E activities and the MS III decision review. Typical developmental tests in Phase III include the Production Qualification Test (PQT), follow-on production tests, first article tests, comparison tests, quality conformance inspections, and Post Deployment Software Support (PDSS) tests. TDPs will be developed for each test by the independent developmental evaluator or assessor, followed by the DTPs written by the developmental tester. DTRRs shall be conducted, and the PM shall formally certify via the DTRS that the system is ready for the PQT to be conducted. Developmental testing in Phase IV consists of post-production testing, a follow-on to production testing, and includes those surveillance and reconditioning tests required to measure the ability of materiel in the field, in storage, and after maintenance actions (to include repair, rebuild, retrofit, overhaul, and modifications) to meet user requirements (See Parts Four and Seven). The typical operational

test conducted in Phase III is the FOT, if necessary. The independent operational evaluator will develop a TEP for the FOT and OTRRs and OTRSs are required prior to the start of the FOT. There is no required operational testing during Phase IV however, the results of Army Training and Evaluation Programs (ARTEP), Field Training Exercises (FTX), reforgers, and Sample Data Collection (SDC) are all sources of information from which the independent operational evaluator can continue to periodically monitor the systems continuing ability to meet the identified mission need (See Part Five).

(2) Execution. The PQT is the principal development test in Phase III. It is a system-level test to verify that the production system meets contract specifications and technical parameters, to determine the adequacy and timeliness of any corrective actions indicated by previous testing, and to validate the manufacturer's facilities, procedures, and processes. The FOT shall be conducted as necessary to ensure that the production version of the system performs as well as reported at MS III, demonstrates expected performance and reliability improvement, evidences correction of deficiencies identified during earlier tests, ensures that new problems have not been injected by the production process, and determines overall readiness of the system to be fielded. All testing in Phase III is focused on confirming fixes to problems identified in earlier tests (See Parts Four, Five, and Seven).

(3) Reporting. After each developmental test in Phase III, a TR shall be written by the independent developmental tester and provided to the independent developmental evaluator or assessor for inclusion in the IER or IAR. A TER will be developed by the independent operational evaluator to provide a status of the system resulting from the FOT. An OA will be used by the independent operational evaluator to report on system status at intermediate decision reviews, or if the FOT is ongoing and results are incomplete (See Parts Four, Five, and Seven).

(INSERT FIGURE 4-16 HERE)

c. Continuous Evaluation Activities. Figure 4-17 contains the CE activities to be conducted during Phase III and Phase IV (See Parts Four, Five, and Seven).

(INSERT FIGURE 4-17 HERE)

4-11. Milestone IV T&E Requirements
A MS IV, Major Modification Approval, review is required only if major upgrades to the system currently in production are warranted. This need may be brought about by a change in the system's threat, a major deficiency identified during FOT or operational training and support, or by an opportunity to reduce the cost of ownership. If a major modification program is approved, the milestone decision authority will determine which acquisition phase the program should enter (See DODI 5000.2).

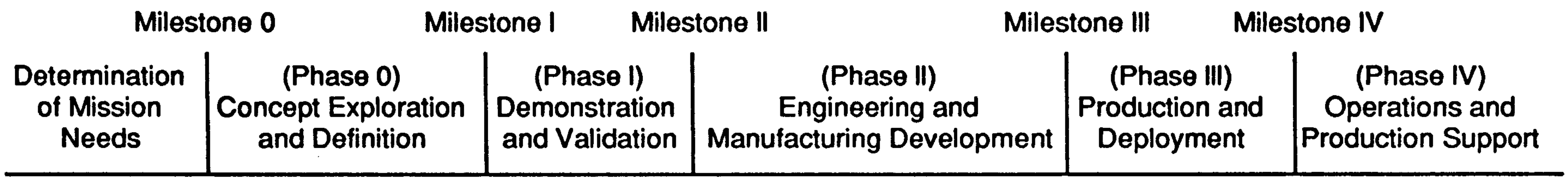

FIGURE 4-1
Life Cycle Management Model
For Materiel Systems

DETERMINATION OF MISSION NEEDS
KEY ACTIVITIES

- Identification of mission deficiencies or improvement opportunites.

- Evaluation of nonmateriel solutions to satisfy mission deficiencies.

- Development of MNS if nonmateriel solutions are not feasible.

Figure 4-2.

CONCEPT EXPLORATION AND DEVELOPMENT
Phase 0
KEY ACQUISITION ACTIVITIES

- Definition and evaluation of the feasibility of alternative concepts.
- Definition of the most promising system concept.
- Establish a proposed Concept Baseline.
- Development of a proposed acquisition strategy for the most promising concept.
- Development of key system characteristics and operational constraints.
- Development of proposed program-specific exit criteria that must be accomplished during Phase I.

Figure 4-3.

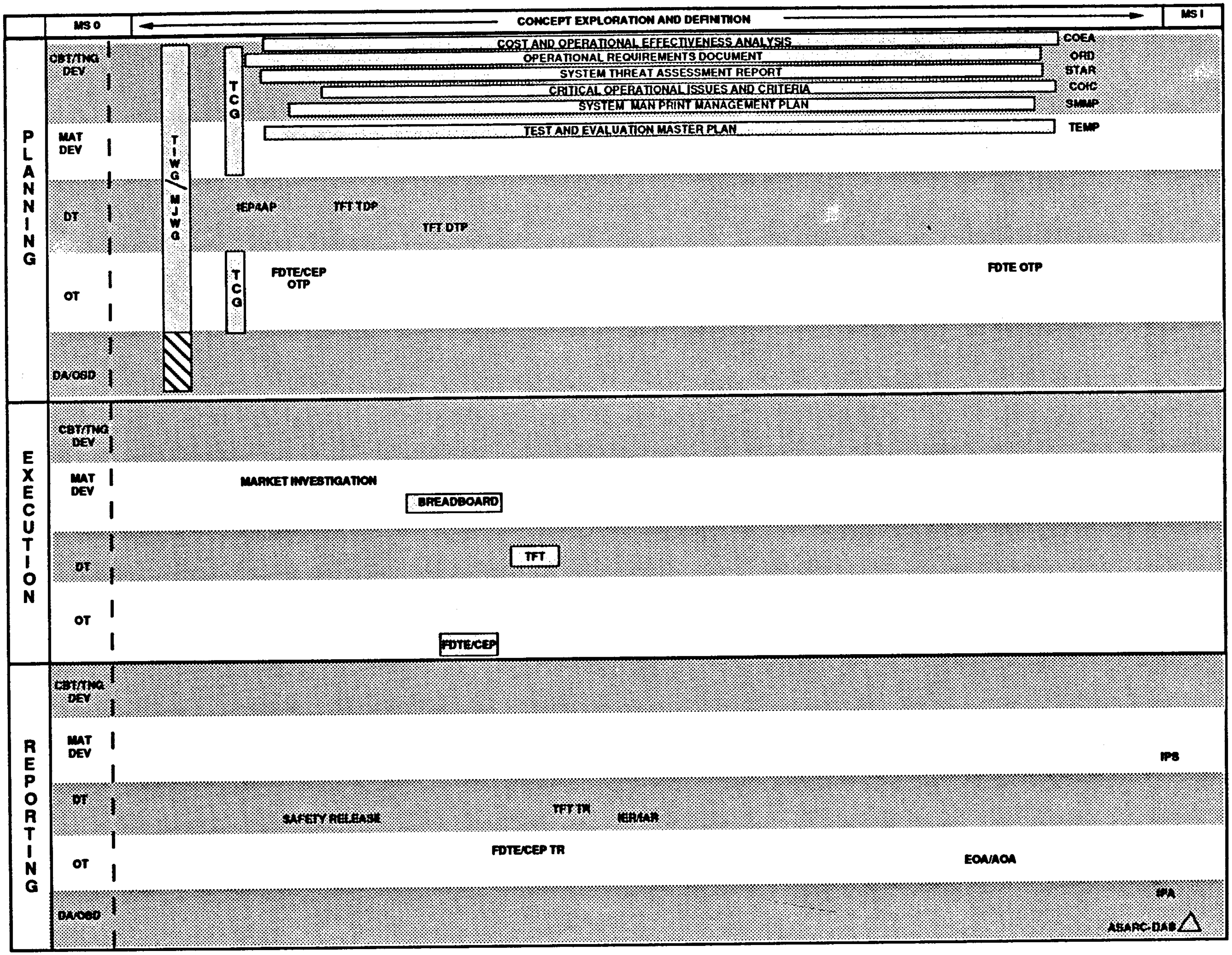

Figure 4-4 Phase O, Concept Exploration and Definition

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
DURING CONCEPT EXPLORATION/DEFINITION
Phase 0

- Participate in the TIWG.
- Assist in selecting the preferred alternative to resolve mission area deficiencies.
- Participate in ORD development efforts.
- Support the initial COIC development and approval process.
- Assist in developing system characteristics and exit criteria.
- Participate in development, staffing, and approval of the TEMP.
- Plan and execute all required developmental and operational tests.
- Develop and provide developmental IER or IAR to appropriate decision makers.
- Develop and provide EOA or AOA to support MS I decision.

Figure 4-5.

MILESTONE I T&E REQUIREMENTS

- Draft ORD.
- Approved initial COIC.
- Preliminary TEMP.
- Developmental IER or IAR; EOA or AOA.

Figure 4-6.

DEMONSTRATION AND VALIDATION
Phase I
KEY ACQUISITION ACTIVITIES

- Better define the critical design characteristics and expected capabilities of the system concept.

- Refinement of the AS.

- Establish a proposed Development Baseline.

- Development of proposed program-specific exit criteria that must be accomplished during Phase II.

- Determine plan for committing to low-rate initial production.

Figure 4-7.

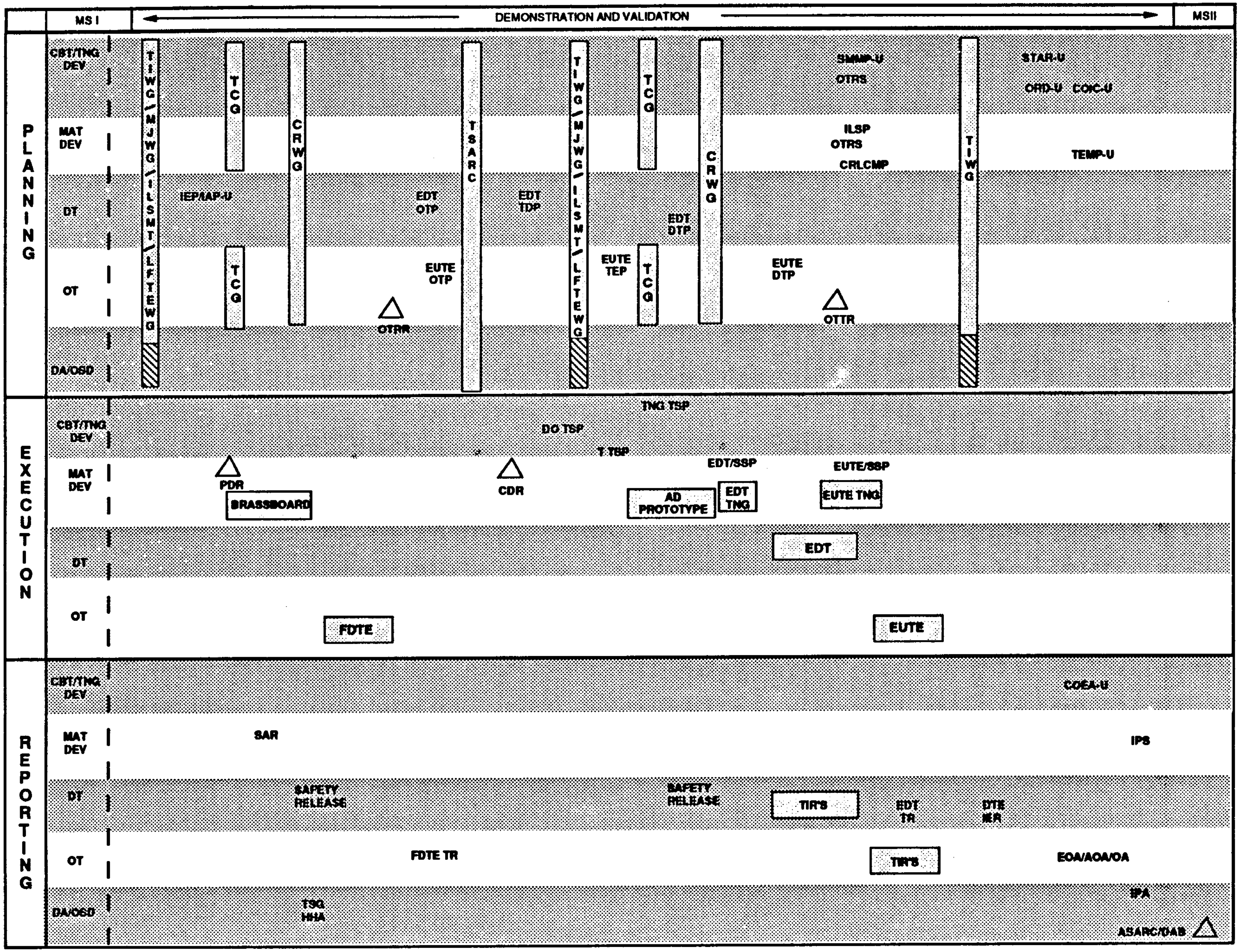

Figure 4-8 Phase I, Demonstration and Validation

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
DEMONSTRATION AND VALIDATION
Phase I

- Continued participation in the TIWG.
- Support the COIC update and approval process.
- Support the ORD update and approval process.
- Participate in the update, staffing, and approval of the TEMP.
- Support COEA update efforts.
- Assist in the development of exit criteria.
- Plan and execute all required developmental and operational tests.
- Develop and provide developmental IER or IAR to appropriate decision makers.
- Develop and provide EOA, AOA, or OA to support intermediate decision and MS II decision.

Figure 4-9.

MILESTONE II T&E REQUIREMENTS

- Updated ORD.
- Updated COIC.
- Updated TEMP.
- Developmental IER or IAR; EOA, AOA, or OA.

Figure 4-10.

ENGINEERING AND MANUFACTURING
DEVELOPMENT
Phase II
KEY ACQUISITION ACTIVITIES

- Validate the manufacturing and production process.
- Refinement of the AS.
- Establish a proposed Production Baseline.
- Establish system configuration baseline.
- Demonstrate through testing that system capabilities meet contract specifications, satisfies the mission need, and meets the minimum acceptable operational performance requirements.
- Demonstrate that the low-rate initial production provides assurance that the design is stable and capable of being produced efficiently.
- Development of proposed program-specific exit criteria that must be accomplished during Phase III, if appropriate.

Figure 4-11

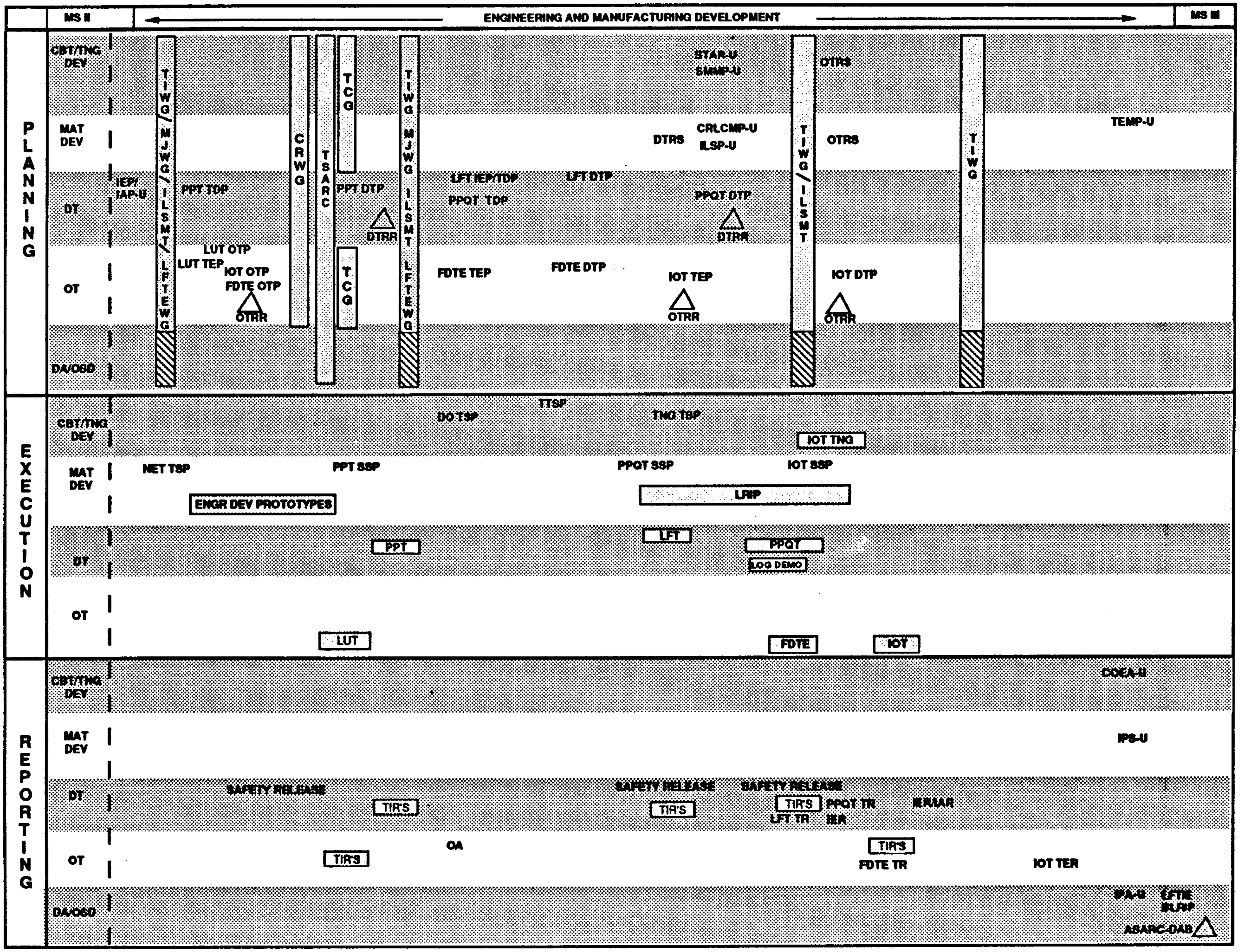

Figure 4-12 Phase II, Engineering and Manufacturing Development

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
ENGINEERING AND MANUFACTURING DEVELOPMENT
Phase II

- Continued participation in the TIWG.
- Support the COIC update and approval process.
- Support the ORD update and approval process (if appropriate).
- Participate in the update, staffing, and approval of the TEMP.
- Support COEA update efforts.
- Assist in the development of exit criteria, if appropriate.
- Plan and execute all required developmental and operational tests.
- Develop and provide developmental IER or IAR to appropriate decision makers.
- Develop and provide operational TER to support MS III decision, and OAs to support intermediate decision reviews.

Figure 4-13

MILESTONE III T&E REQUIREMENTS

- Updated ORD, if appropriate.
- Updated COIC.
- Updated TEMP.
- Developmental IER or IAR; Operational TER and OA.

Figure 4-14.

PRODUCTION AND DEPLOYMENT
Phase III
OPERATIONS AND SUPPORT
Phase IV
KEY ACQUISITION ACTIVITIES

- Update configuration baseline.
- Refinement of cost information.
- Through testing, confirm and monitor performance and quality and verify correction of defieciencies.
- Ensure the fielded system continues to provide the capabilities required to meet the identified mission need.
- Identify the need for major upgrades to the system currently in production that require a MS IV, Major Modification Approval, review.

Figure 4-15

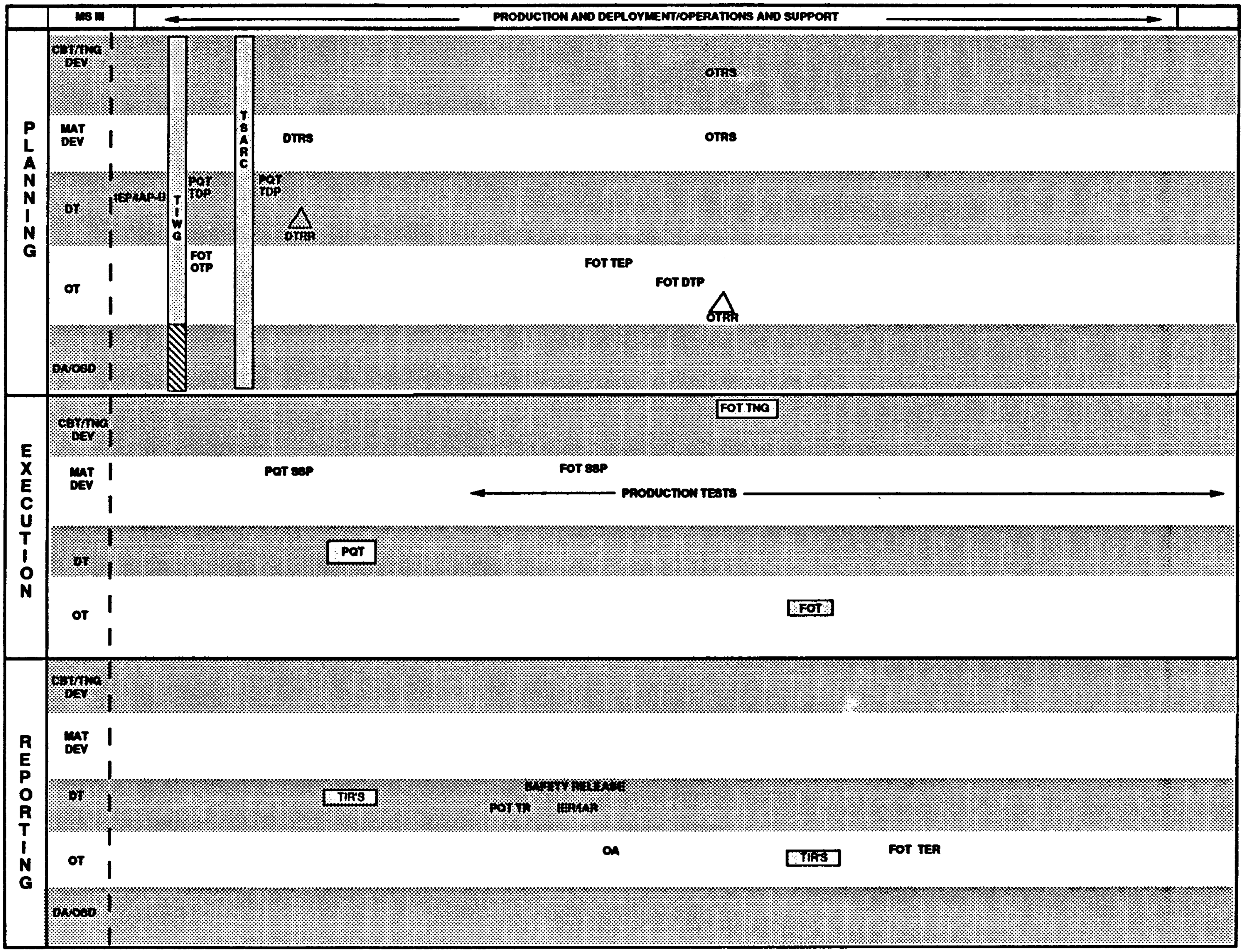

Figure 4-16 Phase III, Production and Deployment/Phase IV, Operations and Support

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
PRODUCTION AND DEPLOYMENT
Phase III
OPERATIONS AND SUPPORT
Phase IV

- Continued participation in the TIWG.

- Plan and execute all required developmental and operational tests.

- Develop and provide developmental IER or IAR to appropriate decision makers.

- Develop and provide operational TER and OAs to support intermediate decision reviews.

- Assist in the identification of deficiencies which may warrant a MS IV (Major Modification Approval) review.

Figure 4-17

Chapter 5
Test and Evaluation in Support of the Information Mission Area Acquisition Process

Section I
Introduction

5-1. General

a. T&E is an essential activity in support of the acquisition of information systems, systems that evolve, are acquired, or are developed which incorporate information technology. These information systems belong to the five Information Mission Area (IMA) disciplines discussed in AR 25-3. T&E in support of the IMA acquisition process plays a key role in the life cycle of information systems, providing data to assist in their selection, development, acquisition, use, maintenance and support. T&E is inherent in the activities that provide new information technologies to be exploited; it is used to support the selection of best solutions to satisfy an IMA deficiency; and it verifies that the Army is designing, developing, producing, and maintaining information systems that satisfy the users' needs.

b. Comprehensive developmental and operational testing shall be conducted on all information systems. Early detailed software T&E planning is critical to meaningful evaluations and assessments, as well as to the successful development of the system. The T&E strategy shall specify the impact on risk of the technologies and processes selected for system development during the entire life cycle of the system. Test methodologies shall include realistic software test environments and scenarios.

c. Developmental T&E shall be planned and incorporated into the information system's development process to verify conformance to technical specifications and performance attributes to technical objectives and requirements. Developmental T&E shall encompass the system hardware, software, code documentation, users manuals, training material, interfaces, compatibility, and interoperability with existing or planned systems. Operational T&E shall examine system effectiveness and suitability under operationally realistic conditions when the system is operated by typical users. In addition, the T&E should address the system's compatibility and interoperability with users and other systems.

d. Continuous evaluation (CE) as discussed in Chapter 2 is a

major ingredient in the T&E which supports the IMA acquisition process. It should begin as early as the Project Management Plan (PMP) process and continue through the system's postdeployment activities.

e. Detailed information concerning software T&E of IMA systems is contained in Part Seven. Roles and procedures for all segments of software T&E, including the maintenance of software after deployment, are discussed.

f. The phases and milestones for the life-cycle system management model (LCSMM) for information systems is illustrated in figure 5-1.

(INSERT FIGURE 5-1 HERE)

Section II
T&E Activities During the Need Justification Phase (Phase 0)

5-2. Phase 0 Activities
Phase 0 defines and documents a mission need and validates this need. The phase begins when a mission deficiency is identified or an opportunity is recognized to improve mission performance. This phase ends at MS 0, which formally approves the Mission Need Statement (MNS).

a. Key Acquisition Events. In this phase, the functional proponent (FP) determines whether a mission deficiency or an opportunity to improve an information system is important enough to warrant further analysis and development of a system. The FP ensures that proper planning and evaluation are successfully carried out. The key acquisition activites conducted during this phase are depicted in figure 5-2.

(INSERT FIGURE 5-2 HERE)

b. T&E Activities. T&E is usually not conducted until after the MS I decision. However, in those cases where T&E may be applicable, T&E generally consists of demonstrations to assist in the identification of mission deficiencies; evaluation of the impact of the deficiencies on the performance of the mission; and evaluation of the impact of essential functional and technical constraints affecting potential alternative solutions.

c. Continuous Evaluation Activities. If applicable, CE

activities during this phase consist of an evaluation of the impact of deficiencies on the performance of the mission.

5-3. Milestone 0 T&E Requirements
The MNS must be developed and submitted to the milestone decision authority for approval.

Section III
T&E Activities During the Concepts Development Phase (Phase I)

5-4. Phase I Activities
A successful MS 0 decision allows the program to advance into the Concepts Development Phase (Phase I). Phase I identifies and evaluates alternative functional and technical concepts that satisfy the approved MNS, and, based on the results of these evaluations, selects the best functional or technical concept.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 5-3.

(INSERT FIGURE 5-3 HERE)

b. T&E Activities. T&E will support the evaluation of alternative concepts that satisfy the approved MNS and support the selection of the best functional or technical concept. Initial planning for T&E shall begin in this phase, including the establishment of requirements for independent T&E and quality assurance programs. Modeling and simulation, rapid prototyping, and any other techniques shall be considered to reduce program risks and future costs. Metrics for cost and schedule shall be developed and integrated into the T&E strategy. Figure 5-4 illustrates the typical planning, execution, and reporting activities conducted during this phase.

(1) Planning. The PM shall establish the TIWG during this phase (See Chapter 8). The UFD will be developed and used in conjunction with the MNS to develop and finalize initial COIC (See Part Three). The preliminary TEMP will also be developed by the TIWG (See Part Two). T&E planning will be incorporated in the acquisition strategy, the RFP, the SDP, and other supporting documentation for the milestone decision authority for MS I.

(2) Execution. Typically no developmental or operational testing is conducted during this phase.

(3) Reporting. If appropriate, an EOA may be required to

assess the potential of the selected concept with respect to operational effectiveness and suitability (See Parts Five and Seven).

(INSERT FIGURE 5-4 HERE)

c. Continuous Evaluation Activities. Figure 5-5 contains the CE activities to be conducted during this phase (See Part Seven).

(INSERT FIGURE 5-5 HERE)

5-5. Milestone I T&E Requirements
Figure 5-6 contains the T&E requirements to support MS I.

(INSERT FIGURE 5-6 HERE)

Section IV
T&E Activities During the Design Phase (Phase II)

5-6. Phase II Activities
A successful MS I decision allows the program to advance into the Design Phase (Phase II). The purpose of Phase II is to complete the technical specifications of the information system and to validate the selected system design.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 5-7.

(INSERT FIGURE 5-7 HERE)

b. T&E Activities. T&E will support the completion of the technical specifications and support those remaining demonstration and prototyping activities. Adequate T&E shall be accomplished to complete the identification of the technical risks associated with the selected design, and shall establish realistic system performance and suitability thresholds. Modeling, simulation, and prototyping are encouraged to support an EOA prior to MS II. In addition to the metrics developed in the previous phase, metrics for computer resource utilization (CRU), software engineering environment (SEE), requirements traceability, and requirements stability shall be developed and integrated into the T&E strategy. Figure 5-8 illustrates the typical T&E planning, execution, and reporting activities conducted during this phase.

(1) Planning. TIWG meetings should be held as required to continue planning for developmental and operational T&E, and to update the TEMP in support of MS II (See Part Two). The FD will be finalized and used to update the COIC (See Part Three).

(2) Execution. Typically no developmental or operational testing is conducted during this phase.

(3) Reporting. An EOA, based on demonstrations, modeling, simulation, and other analytical techniques, will be provided by the independent operational evaluator in support of the MS II decision review (See Parts Five and Seven).

(INSERT FIGURE 5-8 HERE)

c. Continuous Evaluation Activities. Figure 5-9 contains the CE activities to be conducted during this phase (See Part Seven).

(INSERT FIGURE 5-9 HERE)

5-7. Milestone II T&E Requirements

Figure 5-10 contains the T&E requirements to support MS II.

(INSERT FIGURE 5-10 HERE)

Section V
T&E Activities During the Development Phase (Phase III)

5-8. Phase III Activities

A successful MS II decision allows the program to advance into the Development Phase (Phase III). The purpose of Phase II is to develop the information system, test the total system to ensure it satisfies the user's requirements, and to prepare the information system for deployment.

a. Key Acquisition Events. The key acquisition activities conducted during this phase are depicted in figure 5-11.

(INSERT FIGURE 5-11 HERE)

b. T&E Activities. T&E will be conducted during this phase on completed prototype, preproduction, or production-representative information systems. The T&E will include all testing required to confirm that all deficiencies have been identified; that solutions to these problems are available; and to provide a valid estimate of the system's safety, operational

effectiveness and suitability. The system design must be sufficiently mature so that the tested system will provide data to accurately assess the production system. All remaining required software metrics shall be developed and integrated into the T&E strategy. Figure 5-12 illustrates the typical T&E planning, execution, and reporting activities conducted during this phase.

(1) Planning. As early as possible in this phase, the independent developmental evaluator shall develop an IEP to support the developmental evaluation of the system in this phase. Typical developmental tests include software development tests (SDTs), which consist of program or module and cycle or systems levels of testing, and the software qualification test. Unit or module tests are executed on local testbed hardware using benchmark test files. Cycle or system tests involve testing the combination of linkage of programs or modules into major processes. The software qualification test is a total system test conducted by the independent developmental tester using live data files supplemented with user-prepared data and executed on target hardware. A TDP will be developed for the software qualification test, followed by the DTP, written by the developmental tester. DTRRs and DTRSs are required prior to execution of the software qualification test (See Part Seven). Typical operational tests include the LUT, IOT, and FOT (if necessary). Each system shall undergo an IOT in at least one representative site using real functional data. The independent operational evaluator will develop a TEP for each operational test in this phase. OTRRs and OTRSs are required to verify that the system is production-representative and ready for the IOT or FOT to be conducted (See Parts Five and Seven). The DOT&E will approve the adequacy of the IOT TEP for OSD MAISRC systems prior to the conduct of the test (See Part Five). TIWG meetings should be held as required to continue planning for developmental and operational T&E (See Chapter 8). Updates of the COIC and TEMP to support the MS III decision must also be conducted (See Parts Two and Three). OTPs must be developed and participation in the TSARC is required if the planned testing requires user troops and resources (See AR 15-38).

(2) Execution. The system qualification test is the principal developmental test in this phase, serving as the final developmental test prior to the IOT. The PM shall formally certify via the DTRS that the system is ready for the system qualification test to be conducted. The IOT may include the procedures of what was formerly known as the software acceptance test. The IOT must be conducted on production-representative systems to support independent evaluation of the system's

operational effectiveness and suitability. The system tested must be sufficiently representative of the expected production system to ensure that T&E validity supports the production decision. (see Parts Five and Seven).

(3) Reporting. A TR shall be written by the independent developmental tester after the software qualification test and provided to the independent developmental evaluator for input into the IER. A TER shall be written by the independent operational evaluator after the IOT and FOT. An OA will be written if testing is incomplete or a review prior to MS III is requested. Before the MS III review the results of testing (to include all system testing and preproduction qualification testing) of production or production-representative articles shall confirm that all deficiencies have been identified; that solutions to these problems are available; and that the items or components actually tested are effective and suitable for their intended use (See Parts Five and Seven).

(INSERT FIGURE 5-12 HERE)

c. Continuous Evaluation Activities. Figure 5-13 contains the CE activities to be conducted during this phase (See Part Seven).

(INSERT FIGURE 5-13 HERE)

5-9. Milestone III T&E Requirements

Figure 5-14 contains the T&E requirements to support MS III.

(INSERT FIGURE 5-14 HERE)

Section VI
T&E Activities During the Deployment and Operations Phases (Phases IV and V)

5-10. Phase IV and Phase V Activities

A successful MS III decision allows the program to advance into the Deployment Phase (Phase IV). The purpose of Phase IV is to field the information system in accordance with the approved deployment plan. Transition into the Operations Phase (Phase V) occurs when progam control is passed from the PM/MATDEV to the Operations Manager. There is no milestone required for this action. Phase V objectives are to operate and maintain the system, evaluate its effectiveness and benefits, implement the

short-term postdeployment modernization plan, and plan for long-term modernization. MS IV occurs at the end of the Operations Phase (Phase V).

a. Key Acquisition Events. The key acquisition activities conducted during these phases are depicted in figure 5-15.

(INSERT FIGURE 5-15 HERE)

b. T&E Activities. T&E will support the fielding, operation, and maintenance of the information system; support the evaluation of the effectiveness and benefits of the system; support the implementation of the short-term postdeployment modernization plan; and support the long-term existing modernization. TIWG meetings should be held as required to continue planning for developmental and operational T&E (See Chapter 8). The principal T&E efforts will be PDSS tests, which consist of modifications and maintenance of software in deployed systems, the FOT, and, as required, Supplemental Site Tests (SSTs). As early as possible, the independent developmental evaluator shall update the IEP to reflect information resulting from Phase III T&E activities and the MS III decision review. A TDP will be developed for each PDSS test, followed by the DTP, written by the developmental tester (See Part Seven). The independent operational evaluator will develop a TEP for the FOT. DTRRs and DTRSs are required prior to execution of a PDSS test; OTRRs and OTRSs are required prior to execution of the FOT. A TR shall be written by the independent developmental tester after the PDSS test and provided to the independent developmental evaluator for input into the IER. A TER shall be written by the independent operational evaluator after the FOT, or an OA will be written if testing is incomplete or an intermediate review is requested (See Parts Five and Seven). Figure 5-16 illustrates the typical T&E planning, execution, and reporting activities conducted during this phase.

(INSERT FIGURE 5-16 HERE)

c. Continuous Evaluation Activities. Figure 5-17 contains the CE activities to be conducted during these phases (See Part Seven).

(INSERT FIGURE 5-17 HERE)

5-11. Milestone IV T&E Requirements

MS IV T&E requirements include the developmental IER, the operational TER, and any operational OAs.

Section VII
T&E Activities During the Revalidation Phase (Phase VI)

5-12. Phase VI and MS V Activities

The purpose of the Revalidation Phase (Phase VI) is to determine whether the information system conforms to architectural requirements and continues to satisfy mission needs, or should be terminated. The activities undertaken by the FP and Operations Manager include ensuring that all class II through V programs receive a MS V Revalidation review by the appropriate approving authority. If a revalidation review results in approval to implement system modernization, the approval authority will determine which acquisition phase the system will enter. No T&E activities are usually required during this phase, however all participants in the CE process should monitor the information system with respect to potential implementation of modernizations (See Part Seven).

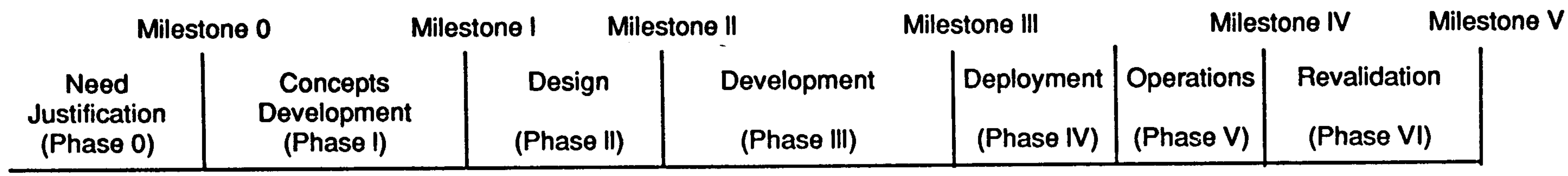

FIGURE 5-1
Life Cycle Management Model
For Information Systems

NEED JUSTIFICATION
Phase 0
KEY ACQUISITION ACTIVITIES

- Identification of mission deficiencies or improvement opportunites.

- Identification of essential functional, technical, and financial constraints and assumptions which affect potential alternative solutions.

- Integration of the results of these activities into the MNS.

Figure 5-2

CONCEPTS DEVELOPMENT
Phase I
KEY ACQUISITION ACTIVITIES

- Assessments of alternative functional and technical concepts.
- Selection of the best functional or technical concept to satisfy the mission need.
- Evaluation and selection of the appropriate acquisition strategy to implement the recommended program.
- Initial planning for the design, development, testing, deployment, training, maintenance, and modernization (if appropriate) of the proposed information system.
- Development of the Configuration Management Plan (CMP).

Figure 5-3

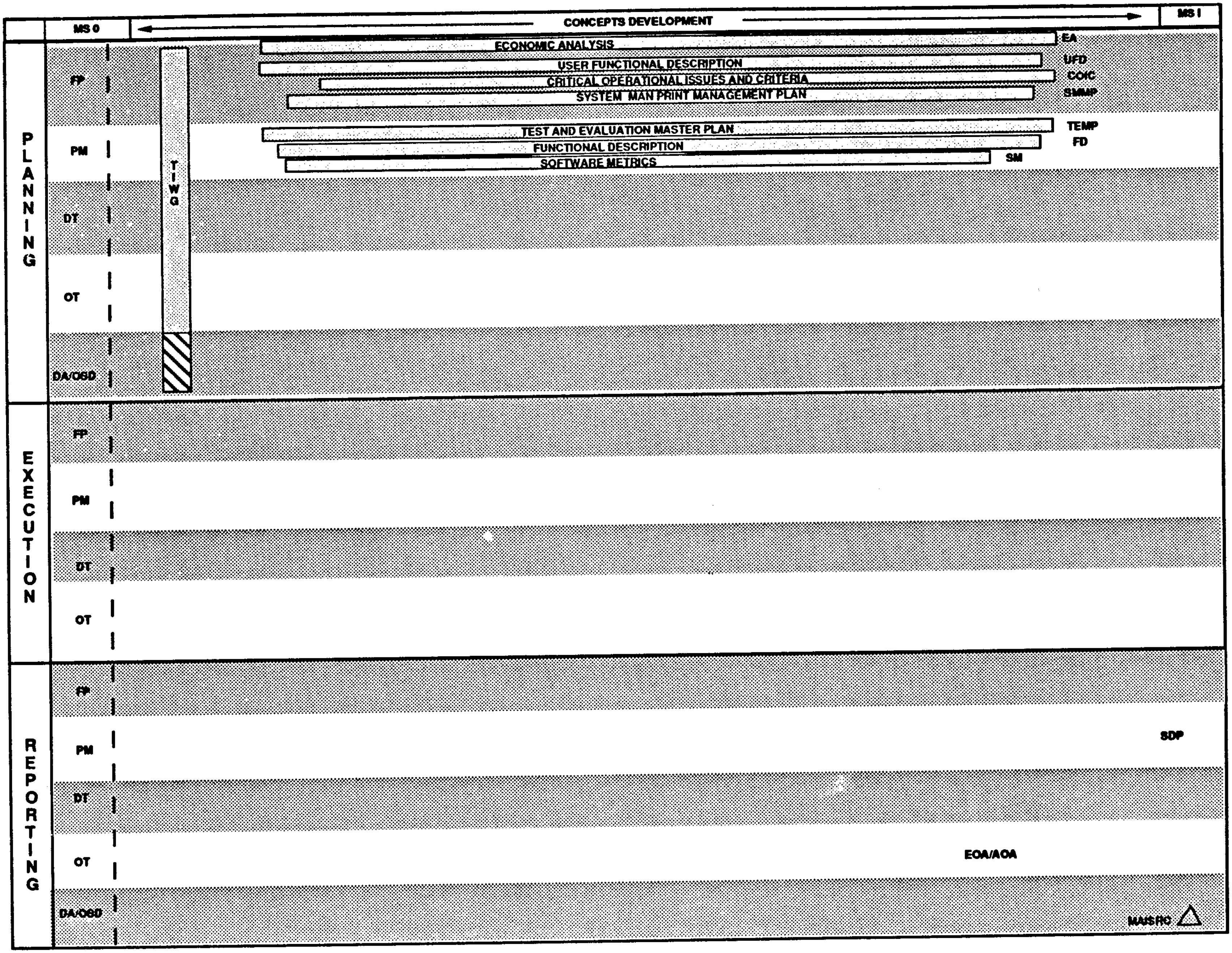

Figure 5-4 Phase I, Concepts Development

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
CONCEPTS DEVELOPMENT PHASE
Phase I

- Determine if the system requirements are testable, and that measurable criteria are established.

- Ensure that user requirements are traceable to the system specifications.

- Ensure that the cost and schedule software metrics are properly developed and incorporated into the T&E strategy.

- Develop and provide EOA to appropriate decision makers.

Figure 5-5

MILESTONE I T&E REQUIREMENTS

- Updated and revalidated MNS.
- Validated UFD, and draft FD.
- Initial COIC.
- Preliminary TEMP.

Figure 5-6

DESIGN
Phase II
KEY ACQUISITION ACTIVITIES

- Ensuring that the system design is based on functional requirements, including the FD.

- Integration of results of remaining demonstrations and prototyping activities into the system design.

- Selection of modern development technologies to be used in system development.

- Development of a product baseline in accordance with the CMP.

Figure 5-7

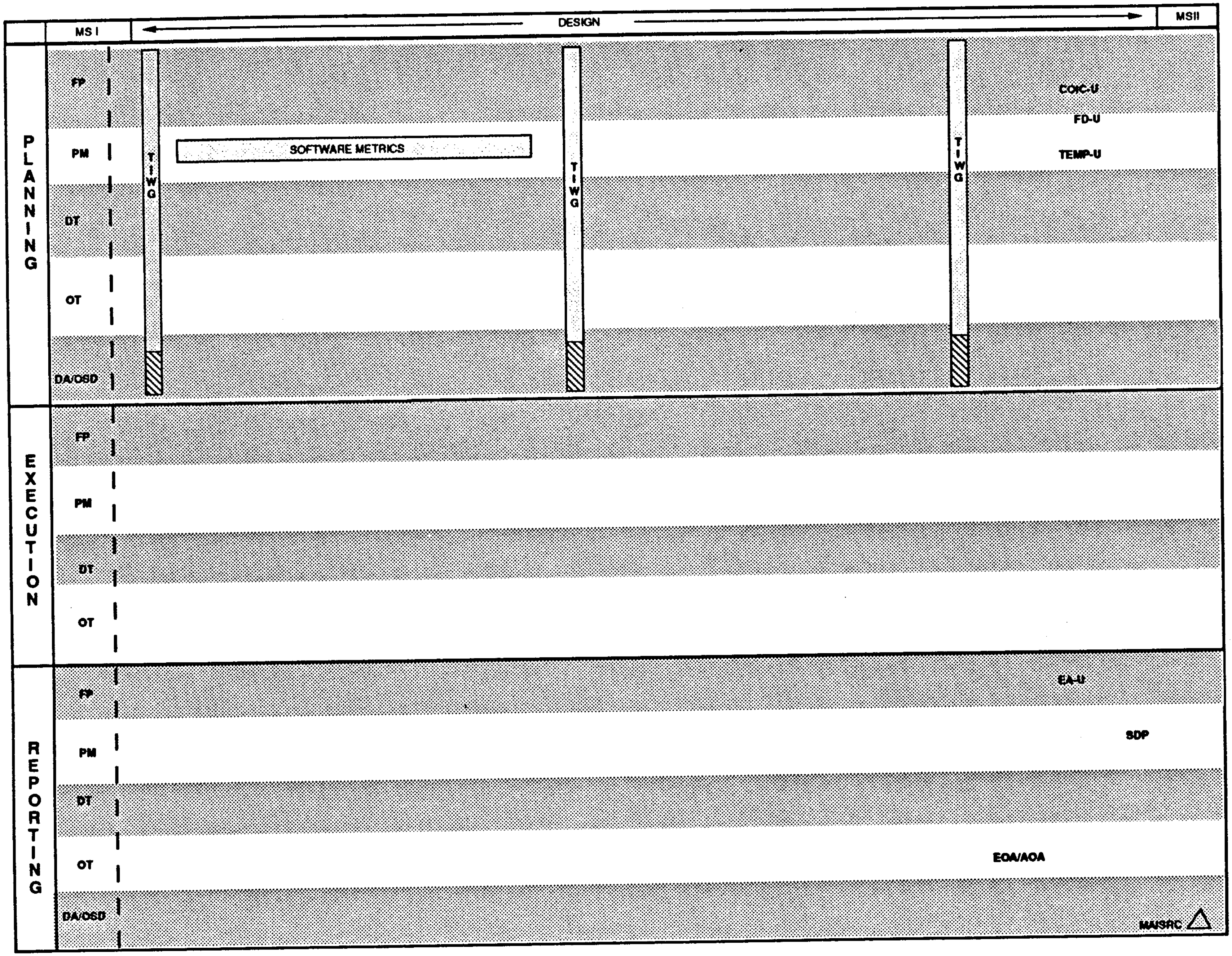

Figure 5-8 Phase II, Design

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
DESIGN PHASE
Phase II

- Ensure that the requirements in the UFD, FD, and MNS are traceable to the system specification and among each other.

- Ensure that performance and suitability thresholds have been properly determined and are reflected in the TEMP.

- Ensure that the required software metrics are properly developed and integrated into the T&E strategy.

- Develop and provide EOA to appropriate decision makers.

Figure 5-9

MILESTONE II T&E REQUIREMENTS

- Finalized and validated FD.
- Updated COIC.
- Updated TEMP.
- EOA provided by the independent operational evaluator.

Figure 5-10

DEVELOPMENT
Phase III
KEY ACQUISITION ACTIVITIES

- Full-scale information system development.
- Conducting developmental and operational testing to validate that the system design is stable and that it meets user functional requirements.
- Validation that the information system is ready for peacetime, mobilization, and wartime operational use.
- Planning for deployment, training, operations, maintenance, and logistic support of the information system.

Figure 5-11

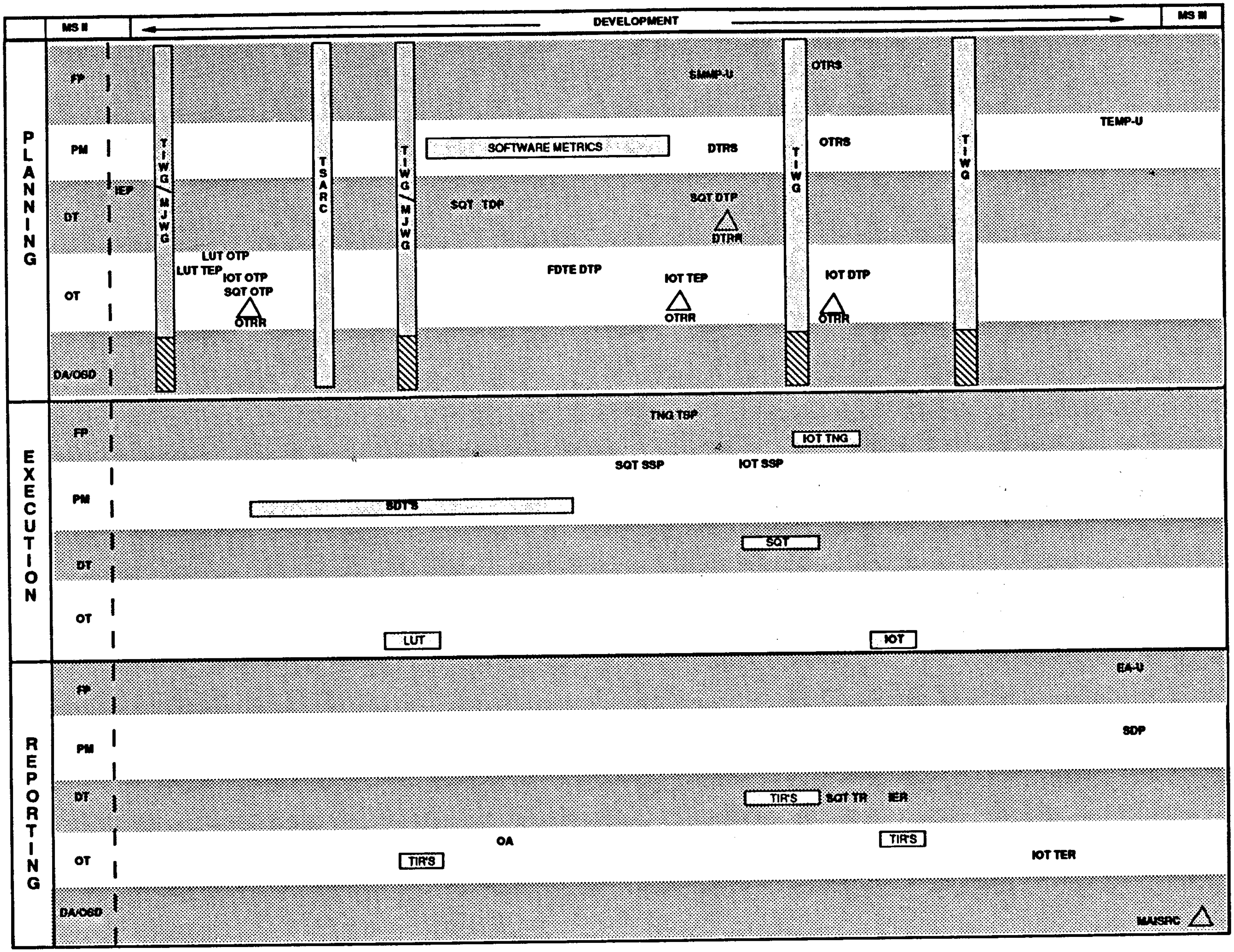

Figure 5-12 Phase III, Development

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
DEVELOPMENT PHASE
Phase III

- Continue participation in the TIWG and TEMP update process.
- Plan and execute all required developmental and operational tests.
- Ensure that all required software metrics are properly developed and integrated into the T&E strategy.
- Develop and provide developmental IER to appropriate decision makers.
- Develop and provide OA to support intermediate decisions.
- Develop and provide TER to support MS III decision.

Figure 5-13

MILESTONE III T&E REQUIREMENTS

- Developmental IER, operational TER.
- Updated COIC (if necessary).
- Updated TEMP.

Figure 5-14

DEPLOYMENT AND OPERATIONS
Phase IV and Phase V
KEY ACQUISITION ACTIVITIES

- Transition planning from the PM/MATDEV to the information system Operations Manager.

- Availability of resources to satisy the requirements of the proposed deployment schedule and full operations and maintenance.

- Postdeployment operational assessment planning for the MS IV decision review.

- Planning for existing system modernization assessment.

- Effective operating procedures are developed to evaluate benefits, correct malfunctions, and respond to user needs.

Figure 5-15

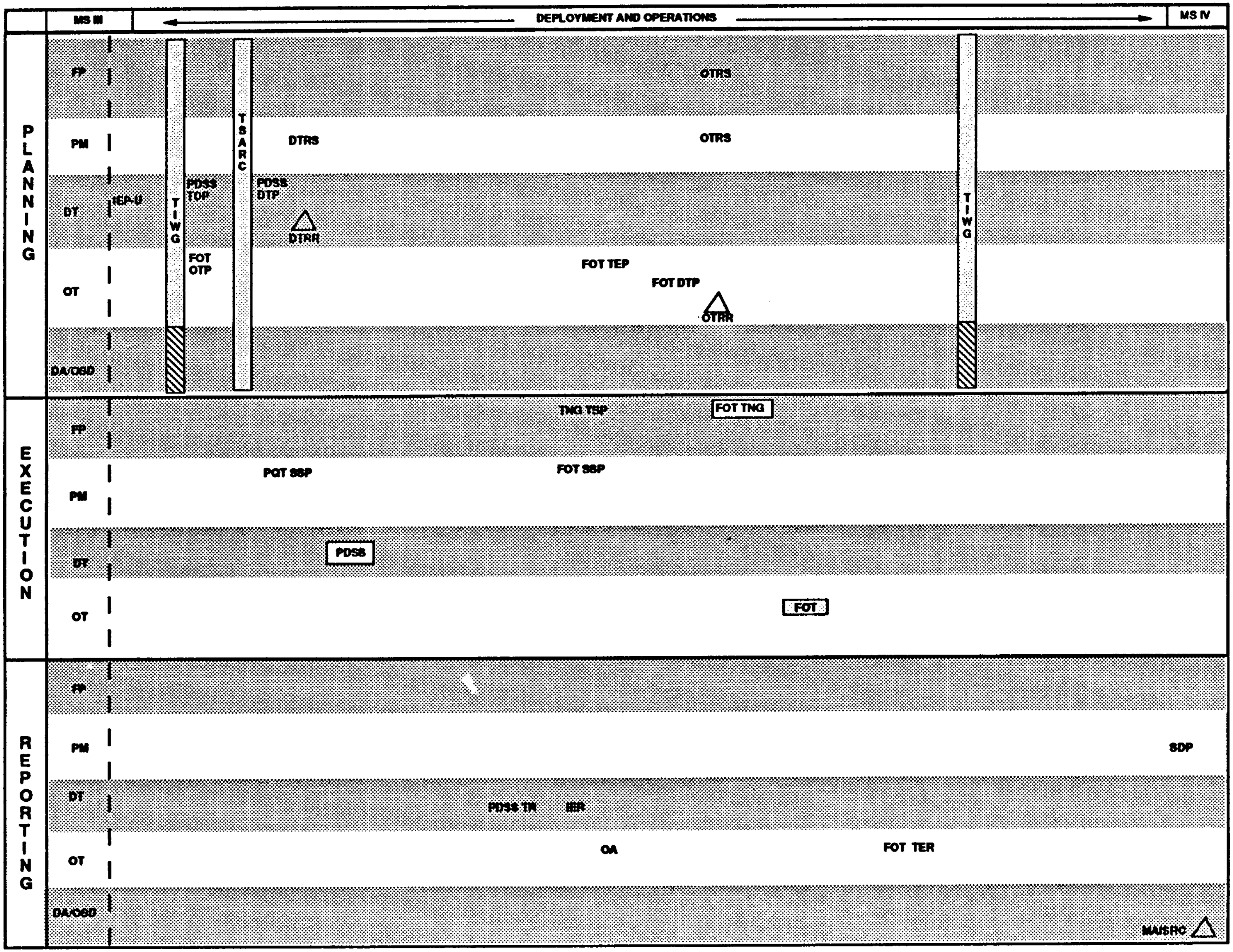

Figure 5-16 Phase IV, Deployment/Phase V, Operations

CONTINUOUS EVALUATION (CE) ACTIVITIES DURING
DEPLOYMENT AND OPERATIONS
Phase IV and Phase V

- Continue participation in the TIWG.

- Plan and execute all required developmental and operational tests.

- Develop and provide developmental IER to appropriate decision makers.

- Develop and provide operational TER and OAs to support intermediate decision reviews.

Figure 5-17

Chapter 6
T&E for Tailored Acquisition

Section I
Introduction

6-1. General
The Army often uses expedited acquisition processes to reduce the acquisition lead time. The Army embarks on these acquisitions through two motivations:

a. To save development and acquisition costs by streamlining the acquisition process for low risk items through Non-Developmental Item (NDI) acquisitions.

b. To quickly field systems to meet urgent operational needs accepting moderate to high risks through DA-directed Limited Procurement (LP) acquisitions.

6-2. Tailoring T&E
Each of the above types of acquisition requires an alternative T&E strategy which differs from the classic T&E strategies laid out elsewhere in this pamphlet.

Section II
NDI Acquisition Process

6-3. NDI Features
NDI acquisitions provide a preferred alternative if the market surveillance reveals that items are available which have a high probability of meeting the users' requirements.

a. NDI feasibility may surface before preparation of the MNS or may be identified during the market investigation. This is based upon continuous market surveillance, front-end analysis, responses to Mission Area Analysis deficiencies, and the proposed solution in the MADP. The market investigation becomes much more important as a data source for NDI systems and often is the only source prior to a milestone I/III decision review.

b. T&E requirements to support NDI acquisition approaches do not differ appreciably from the T&E requirements for a developmental program: a TIWG must still be formed; a TEMP is still required; test data must be available; and developmental

and operational evaluations must be performed.

6-4. NDI Tailoring Opportunities
NDI invites considerable tailoring of the acquisition process, depending on the extent of trade-offs and testing required to verify achievement of system characteristics and technical parameters and of operational effectiveness and suitability. Maximum use should be made of existing documentation, verification data, and related evaluations to tailor the acquisition. Documented results of Market Surveys or Market Investigations and data from contractor testing may be adequate to evaluate the system.

6-5. Acquisition of NDI
Nondevelopmental item acquisition is a generic term that covers systems or pieces of equipment which may require limited development effort by the Army. NDI include materiel developed and in use by other U.S. military services or government agencies, materiel developed and in use by other countries, and materiel available commercially. There are two general categories of NDI and a third level of effort not designated as a separate category. Examples of this tailoring include:

a. Basic NDI. Basic NDI consists of off-the-shelf items (e.g. commercial, foreign, other services) which will be used in the same environment for which they were designed and will require no modification. These systems may be able to undergo a single decision review (Milestone I/III) to verify sufficiency of the item against the requirement and initiate type classification with reduced MDR documentation.

b. NDI Adaption. NDI Adaption consists of off-the-shelf items to be used in an environment different than that for which designed and which will require modification to satisfy requirements through a highly abbreviated EMD phase. These systems may be able to undergo a combined Milestone I/II decision review and a Milestone III decision review to approve production.

c. NDI Integration. NDI Integration is focused on the integration of existing proven components. This category may require some hardware and software development and integration. MS I and MS II decisions occur very close together and the MS II decision point may be waived based on a judgement that there is no need for development. NDI feasibility surfaces during the normal requirements generation process with the preparation of an Mission Need Statement (MNS) and a preliminary determination of whether NDI is a viable option. This determination by the MATDEV is based on an initial analysis of

the operational requirements in the MNS versus technology or materiel already developed and in existence (e.g., foreign-made materiel). The criteria for a viable option is that a facsimile system or elements of a system are already operationally successful and are adaptable to the operational requirements specified in the MNS.

6-6. Advantage of NDI
An important advantage of NDI alternatives is reduced acquisition time. This is accomplished, in part, by minimizing Army testing on NDI. General guidance is that we will not test when existing date (contractor or other sources) affords an estimate of system perfomance at a level of confidence appropriate to the mission. It is imperative that independent evaluators get involved early, participate in the formulation of the acquisition strategy and market survey or investigation plans, and provide developmental or operational evaluation and assessment reports.

6-7. NDI Documentation
The following documents cannot be "tailored out" of the acquisition process:

a. IPS.

b. MNS.

c. ORD.

d. Acquisition Strategy.

e. COEA.

f. Documented Report of Market Survey or Investigation.

g. TEMP.

h. ILSP.

i. SMMP.

j. TC Action.

6-8. NDI Type Classification Actions
Type classification (TC) is required for NDI acquisitions, unless specifically exempted by regulation.

a. TC Generic. This designation is used only for NDI items, and is the first TC step when a specific make and model of an

item are not initially known. It is based on performance specifications or functional purchase description, and is used to procure items for T&E. After a manufacturer is selected, all test procedures and acceptance criteria are satisfied, and the make and model number are identified, the item must be type classified Standard before procurement for fielding can begin. This determination is made by the MDA.

b. TC Standard. An NDI may be type classified standard if it meets all provisions for TC Standard. These include: the item has been accepted for the operational mission intended, is supportable in its intended environment, possesses a complete technical data package, including ILS and maintenance support.

c. Other interim TC designations may be applied to NDI,if required.

6-9. NDI Acquisition Process Flow
The acquisition process to be used for an NDI strategy is basically the same as the established acquisition process for developmental acquisitions. Process flow described herein is a "typical" listing of activities that would normally take place in an NDI acquisition. Actual process activities may differ somewhat on a case-by-case basis, tempered by program specific requirements and degree of tailoring.

a. The NDI acquisition process begins like any other materiel acquisition with generation and validation of a MNS prior to MS O and authorization from the MDA at MS O to study alternative solutions. After milestone O approval, the MATDEV and CBTDEV jointly study alternative materiel concepts to identify the most promising potential solution(s) to the validated user need.

b. NDI feasibility surfaces during the normal process of identifying alternatives. After the CBTDEV establishes operational requirements representing essential user needs, the MATDEV assesses technical feasibility and makes a preliminary determination of NDI suitability.

c. The MATDEV then conducts a market survey or investigation based upon the MNS and has the objective of determining viability of an NDI approach or of the existence of other streamlining opportunities.

(1) The market survey or investigation is tailored to the situation, and involves interaction between, and participation by, the MATDEV, user, independent evaluators, testers, threat integrator, industry, and logistician. The MATDEV should assure

that the independent evaluators review the market survey or investigation questionnaire so that all required data may be collected.

(2) The MATDEV should coordinate the requirement with the International Materiel Evaluation (IME) Office at TECOM to determine what is available on the foreign market (See Section IV, below).

(3) The CBTDEV uses the results of the effort to evaluate effectiveness and suitability of NDI as a potential solution.

d. If the market suggests potential NDI suitability, the MATDEV and CBTDEV conduct an iterative trade-off process evaluating available products, refining draft requirements, and determining acceptable trade-offs in cost, schedule, performance, and supportability. From this analysis the CBTDEV prepares the ORD.

e. Concurrent with initiation of a Market Survey/Investigation, the MATDEV establishes the TIWG and initiates preparation of the TEMP. The TIWG plans and coordinates all T&E to be conducted during the acquisition process and assists in the development of the acquisition strategy and all supporting documentation with T&E implications. The TEMP identifies critical operational issues and critical technical parameters and outlines the approach that will be used to capture required data to perform the developmental and operational evaluations. The TEMP also captures the MATDEV evaluation.

f. The developmental evaluator will prepare IEP/IAP and the operational evaluator will prepare TEP as required to document specific data requirements and sources. These documents are prepared in Phase 0 and are applied in Phase I. The evaluators complete their evaluations and prepare an IER/IAR or OA/EOA that are included in the documentation at Milestone II/III MDR. Although the evaluators are not required to prepare plans and reports to support the market survey or investigation, the MATDEV should share market data and information with the evaluators and solicit their input to the conclusions to be presented at the Milestone I MDR.

g. The TIWG members determine the type and amount of testing required to verify achievement of system characteristics and technical parameters and of operational effectiveness and suitability. The TIWG documents the planned testing in the TEMP. As with all acquisition programs, the T&E community is encouraged

to make maximum use of existing data and sources to minimize testing. Potential data sources include: commercial testing, commercial user data, foreign governments, foreign contractors, third party participants, and independent evaluation agencies such as Underwriter Laboratories and Consumer Reports. When data are not available, or when it is suspect, testing can and should be conducted.

h. The MATDEV initiates development of an NDI acquisition strategy, including any recommendation to the MDA for tailoring out one or more MDR from the process. If the NDI solution involves foreign materiel, the Foreign Comparative Test Program should be considered.

i. Based upon the recommendation of the acquisition team, the decision to proceed with an NDI acquisition is made by the MDA at program initiation, the MS I decision point. The documentation required for MDR vary by ACAT (however, most NDI are ACAT III and IV IPR programs). This review determines the capability of the marketplace to provide an item for the Army and approves the NDI acquisition strategy.

j. Following approval of the acquisition strategy, the MATDEV begins preparation of a system specification (preferably performance based) or a functional purchase description for the solicitation. These documents describe the military requirements to industry.

k. Before the release of the solicitation document, the Acquisition Strategy Report must be approved by the MDA.

l. If required, PPQT (government or contractor) will be conducted before initiation of manufacturing.

m. If required, new equipment training (NET) is conducted. NET may be performed by the contractor.

n. The materiel fielding plan is finalized and the materiel fielding agreement completed jointly by the MATDEV and the gaining MACOMs. Materiel release will be accomplished in accordance with AR 700-142, and results in fielding of the NDI to the user.

o. ILS is often a particularly difficult aspect of NDI acquisition, demanding ardent management attention from both the MATDEV and the contractor. A successful ILS effort can be achieved only through joint effort between the MATDEV, CBTDEV and the contractor. Emphasis of the early ILS effort is to define

supportability related system characteristics to be included in the system specification, thereby influencing the ultimate selection of the item.

p. MANPRINT is a major consideration in determining whether or not NDI is a suitable acquisition strategy. MANPRINT activities will predict system demands on future personnel inventory, and whether there are unsupported requirements, i.e., human factors engineering issues and mental training burden. Early NDI efforts must focus on identifying MANPRINT issues and developing accommodations or "work-arounds." Where there are shortfalls, trade-offs should be conducted to determine the impacts of modifying the NDI to correct shortfalls versus the consequences of accepting known MANPRINT limitations

r. Safety, health, and environmental hazards should be evaluated at MDR to determine whether they pose acceptable levels of risks in accordance with system safety risk management requirements of AR 385-16. A comprehensive system safety program plan (MIL-STD-882) should be developed early in the NDI acquisition program to clearly define the system safety role in each phase of the acquisition process.

6-10. RAM for NDI

Quantitative RAM requirements should be developed for the NDI. Prior to the MS I review, a tailored RAM Rationale Report (RRR) should be prepared based on mission needs and a thorough user analysis of market surveys and investigation results. RAM parameters contained in the RRR will be considered against the characteristics of items available in the marketplace.

a. Many approaches can be taken to gather valid RAM data from the market. One approach is to review any RAM analysis that the manufacturer performed in the development of the item. In market surveys or investigations, a range of values limiting RAM requirements may be used as a baseline for the RAM assessment. When quantitative RAM data ares not available, it may be possible to assess relative RAM values or to perform a qualitative assessment of RAM based on subjective feedback from existing commercial users.

b. If either independent evaluator determines that the Market Survey or Investigation did not provide data adequate to resolve RAM issues, testing may be required. The TIWG should be convened to provide alternative solutions to satisfy RAM issues for the system. Evaluators should not demand RAM data in rigid formats, but should be flexible in accepting and adapting available market data that can be used to answer the essential questions.

c. When Market Surveys or Investigations or Army testing demonstrate that commercially available materiel cannot meet the CBTDEV RAM requirements, several alternatives exist. Existing commercial equipment may be modified to meet RAM requirements, or existing mission profiles may be modified to see if commercially demonstrated RAM values are acceptable. When RAM is an extremely critical design characteristic and the commercial RAM parameters are far inferior to the requirements, the NDI strategy may need to be abandoned and a traditional development considered.

Section III
NDI T&E Process

6-11. Test and Product Assurance of NDI
An important advantage of NDI alternatives is reduced acquisition time, partially due to the ability to minimize Army testing on NDI. Every effort should be made to evaluate the achievement of the system characteristics and technical parameters and of the operational effectiveness and suitability of the NDI using existing data from the contractor or any other credible source. If contractor and commercial user data are not sufficient, the minimum amount of testing necessary to conduct he required developmental and operational evaluations should be performed. In all cases, however, a developmental IER or IAR and operational TER or AOA will be required to support the MS III decision.

6-12. Testing before Milestone I
Testing prior to MS I should be limited to only that which is essential to support an NDI decision. These tests are sponsored by the MATDEV (usually TFT conducted by TECOM) or the CBTDEV (usually CEP tests conducted by OPTEC), not the independent evaluators. These tests are an extension of the market survey/investigation effort. Prior to any dedicated Army testing, the following sources should be searched for relevant data:

a. Manufacturer's test results.

b. Manufacturer's specifications or technical data packages.

c. User failure data.

d. Independent testing agencies test results,

6-13. Testing after Milestone I
The type and amount of testing that will be performed after MS I

will be determined by the TIWG members and documented in the TEMP. Testing and independent evaluations will be in accordance with the IEP/IAP and TEP. The TIWG members should minimize testing needs as much as possible and maximize the use of existing data to perform the evaluations and assessments.

a. DT and OT. DT and OT should be limited to data acquisition that is essential to the decision making process, and for which there are no existing data available. When both DT and OT are required, maximum effort should be made to combine the testing.

b. Developmental and Operational Evaluation. NDI acquisitions require evaluations by both the DIE and IOE. IER/IAR or TER/AOA are provided at each MDR by the evaluators. Every effort should be made to perform these evaluations using existing data.

6-14. Post MS III Testing

Testing of the NDI after MS III, if required, is oriented to qualification of the manufacturing process and compliance with the technical data package, validation and refinement of operating and support cost data, RAM characteristics, logistics support, training, and provisioning.

6-15. Test and Evaluation Requirements for NDI

No acquisition, including NDI, is exempt from DTE and OTE necessary to verify MANPRINT, quality, safety, RAM, performance, logistics supportability and transportability characteristics of a system. Tests by manufacturers and contractors, previous performance data, and market analysis information may validate acceptability of these characteristics and provide evidence of system operational effectiveness and suitability. However, for the production decision at least minimal T&E is required. OT&E of NDI systems must follow standard DOD policy with regard to system contractor involvement.

6-16. Testing Prior to Initial MDR

Testing should be limited to that absolutely necessary to obtain data necessary to make the NDI decision. This is accomplished through the Market Survey or Investigation.

a. As an initial step, the Army will minimize testing by:

(1) Obtaining and assessing contractor test results.

(2) Obtaining usage/failure data from other customers.

(3) Observing contractor testing.

(4) Obtaining test results from independent test organizations, e.g., Underwriter's Laboratory, National Bureau of Standards.

b. If, based on this initial data collection, it is decided that more information is needed to make a sound NDI decision, the MI may enter into an evaluation phase. NDI candidates may be bought or leased, and DT (TFT) and/or OT (including RAM and logistic support) should be conducted in the operational/combat environment. Safety release procedures, in accordance with AR 385-16, must be followed prior to conducting OT. The results will:

(1) Directly support the AS to accept or reject the NDI alternative.

(2) Influence preparation of requirements documents.

(3) Assist in preparation of solicitation documents.

c. The test results will not be used to select a specific contractor or product.

6-17. Testing After the Initial MDR
All testing after the initial MDR must be described and justified in the TEMP and specifically approved by the program decision authority.

6-18. DTE for NDI
No DT is conducted unless the DIE identifies specific information needs that cannot be satisfied by contractor or other test data sources. The DIE will not demand data in rigid formats, but will be flexible in accepting and adapting data that answer essential questions.

a. Risks associated with hardware/software modifications (NDI category B) and the third level of NDI effort involving integration of components will be carefully considered when determining test requirements. DT requirements are tailored to each specific system.

b. Conduct (as a minimum) DTE to verify integration and interoperability with other system elements. Additional T&E, as appropriate, will be conducted to evaluate and control risk. PPQT and PQT should be identically designed. If the PPQT is completely successful, the PQT can be waived in favor of a FAT. If the PPQT is partially successful, the PQT can be redesigned to address only those parameters which are still in question.

c. The following is provided as general guidance, not rigid requirements, of the testing activities appropriate for the following NDI options:

(1) Off-the-shelf items to be used in the same environment for which they were designed (i.e., no development or modification of hardware or software is required) will normally not require developmental testing before MS I/II or I/III; however, TFT may be conducted to support the MS decision. When the contract is awarded to a contractor who has not previously produced an acceptable finished product and the item is assessed as high risk, a PQT should be required.

(2) Those off-the-shelf items which require some modification of hardware or operational software (e.g., militarization or ruggedization) will require TFT, unless the decision authority documents that further testing is not required. PPQT is required if feasibility testing results in the necessity for fixes to the item. PQT is required to support materiel release.

(3) An R&D effort is required for NDI items used as subsystems, modules, or components which contribute to a materiel solution. Systems engineering, software modification, and testing is required to ensure a total system meets user requirements and is producible as a system. TFT is required in a military environment. PPQT of the complete system is required. Hardware/computer software integration tests are required and PQT is required.

d. Some follow-on testing of the NDI may be required to verify the adequacy of corrective actions indicated by the PQT.

6-19. OTE for NDI
NDI does not automatically mean no OT will be required. If the MATDEV demonstrates through Market Survey or Investigation data that NDI products will satisfy the requirements document, OT may not be required if the IOE concurs. This determination must be included in the initial MDR documentation (IPS and TEMP) and approved by the MDA.

a. For Basic NDI, IOT will not normally be required.

b. For NDI Adaptation, IOT will be required only when critical issues in the TEP have not been addressed. Prior concurrence by the IOE is required to eliminate IOT.

c. For NDI integration, IOT is always required.

d. Follow-On Evaluation. Testing of the NDI after the first unit is equipped is oriented to the validation and refinement of operating and support cost/data, RAM characteristics, logistic support, training, provisioning planning, etc. These tests can materially aid the logisticians in supporting NDI throughout its life-cycle.

6-20. Test Requirements by Type of NDI
Testing requirements will be tailored to each specific system. The following test guidance by NDI category is not a rigid requirement, but general characteristics of testing activities appropriate to each NDI category. The goal of minimum testing still remains regardless of NDI category.

a. Basic NDI. No testing prior to PQT except when the contract awarded to a contractor who has not previously produced acceptable finished products and the item is assessed as high risk. In that case, PPQT should be required.

b. NDI Adaptation. Feasibility testing is required in the military environment. PPQT is required if feasibility testing results in fixes to the item. PQT is required. Limited user evaluation may occur during feasibility and/or preproduction tests.

c. Third Level of NDI Effort (Integration of Components). Feasibility testing is required in military environment. PPQT of complete system is required. Hardware and computer software integration tests required. IOT is required. PQT is required.

Section IV
Foreign Comparative Testing (FCT) Program

6-21. FCT Mission
The mission of the FCT program is to provide cost effective foreign equipment alternatives that meet approved Army requirements, and which, after being successfully tested and evaluated, can be selected in a procurement decision. The FCT involves T&E of weapon systems, equipments, and technologies of allied and other friendly nations with a view toward meeting valid existing Army requirements while reducing duplication in R&D, enhancing standardization and interoperability, improving cooperative support, and promoting competition and international technology exchange.

6-22. FCT Procedures

The FCT program generally fits into the Army acquisition cycle as part of the normal T&E process of NDI materiel. FCT is not a short cut to fielding, but can achieve significant savings in time and funding versus traditional development as R&D is not required. Procedures and criteria for project submissions are contained in DoD 5134.M-2. The following general procedures apply for Army FCT implementation:

a. A MATDEV, acting as the project proponent, can sponsor an item by preparing a Candidate Nomination Proposal (CNP) for the Army FCP Executive Agent, currently AMC. After verifying that the DoD FCT criteria have been met and coordinating the CNP with appropriate Army organizations, the CNP will be forwarded to DoD through SARD-DI for funding. Informal coordination of draft CNP and joint working groups on proposed FCT projects is encouraged.

b. Upon approval of the CNP, detailed plans for developmental and operational evaluations will be prepared by the DIE and IOE and coordinated with the acquisition community. Foreign and contractor data will be used to the maximum extent possible to satisfy evaluation requirements. If sufficient data are not available, test items will be obtained from the foreign country by way of loan, lease, or purchase; whichever is most advantageous to the Army and agreed to by the foreign country.

c. DoD will provide FCT funds directly to the Army FCT Executive Agent who will distribute funding to MATDEV as required/approved. All required plans and reports will flow through the Army FCT Executive Agent which will provide Army policy and oversight of all FCT projects.

Section V
T&E of Limited Procurement (LP) Systems

6-23. LP Process
LP type classification (formerly called Limited Procurement-Urgent or LP-U) is used when a materiel item is required for special use for a limited time. The specified limited quantity for the LP item will be procured without intent of additional procurement of the item under this classification. The LP type classification is used to meet URGENT operational requirements that cannot be satisfied by an item type classified Standard (STD).

6-24. LP Criteria
Criteria for LP type classification of an item required for

urgent operational use will include the following.

a. Existence of an urgent operational requirement, substantiated by the using command representative and CBTDEV or by HQDA.

b. Determination that there is no type classified item that fully satisfies the requirement.

c. Sufficient definition of the military characteristics of the item in materiel requirements documents to allow subsequent evaluation of the item.

d. Demonstration that the proposed item does not qualify for STD and offers no more than a moderate risk.

e. Determination that the proposed item can be economically maintained and logistically supported in the geographic area and time frame for which the type classification is valid.

6-25. Prohibitions Against Misuse of LP type classification
Type classification LP will not be used solely to avoid the checks and balances of the acquisition process or to avoid T&E of the item.

6-26. Operational Field Evaluations
Not later than six months following delivery of the initial shipment of the LP item, the user or requester of the item will collect data and provide an operational field evaluation statement to the program manager or mission assignee agency. Information copies will be provided to HQDA (SARD-RPP), TRADOC, AMSAA, OPTEC, and MRSA.

6-27. Expedited OTE for LP Systems
As the independent operational evaluator and the primary user tester for the Army, OPTEC can perform expeditious operational assessments and supporting LUT to support LP procurement prior to materiel release to the first unit equipped if the urgent requirement permits. OPTEC participation in LPU procurement can cover a spectrum of involvement as follows (This methodology is applicable to both war and non-wartime urgent procurement).

a. Participation in a materiel release decision by rendering an abbreviated operational assessment (AOA) of the system based on program documentation and contractor/developmental testing.

b. Participation in a materiel release decision by rendering an AOA of the system based on program documentation and a

combined DT/OT run by TECOM.

c. Participation in a materiel release by rendering a TER based on results of a quick reaction LUT in addition to results of contractor testing or DT.

6-28. Quick Reaction LUT
The procedures for the conduct of a quick reaction LUT are as follows:

a. Upon receipt of requirements for a quick reaction LUT, the evaluator and the tester will jointly prepare a TEP using CBTDEV COIC, if available. The evaluator will develop additional issues for the TEP. If there are no COIC, the evaluator developed issues will be considered as the critical issues.

b. Evaluator issues will include the following issues in order of priority, but are not limited to these issues:

(1) Does the system have reliability or performance deficiencies which endanger survivability of unit or personnel?

(2) Does the system have reliability or performance deficiencies which endanger performance of the mission?

(3) Does the system have critical or catastrophic safety deficiencies?

(4) Does the system have reliability, maintainability or performance deficiencies which cause excessive logistics burden to using unit or supporting units?

(5) Does the system have reliability, maintainability or performance deficiencies which cause excessive life cycle costs?

(6) What added margin of capability does the system provide to the using unit or the force?

c. The evaluator and tester will prepare a Pattern of Analysis in conference, developing OTMOP to address the issues (see Part Five for details of these OTE peculiar procedures). These OTMOP will form the basis of the test design. The LUT will, as the name implies, be a limited test in scope and duration. The LUT will not be comparable to an IOTE and will not be so structured. Given the joint development of the Pattern of Analysis and the limited scope of test, the evaluator and the tester should be able to complete the TEP in fifteen days or less.

d. Upon approval of the TEP, an OTRR will be held. If all test assets are available, test player training will begin followed by testing for record. Necessary test assets include test items, ammunition, support items of equipment, the system support package and all other test support packages, test funds, test ranges and maneuver areas, test player personnel, and test directorate personnel all of which must be present to begin training of player personnel and start of test.

e. Upon completion of test, a TER will be jointly prepared by the evaluator and tester. The TER will have strict page limits and will be approved and available to decision makers within thirty days after completion of the test. The evaluator will also prepare an executive summary type briefing of the TER.

Section VI
Accelerated Software Development Process for Information Systems

6-29. General

Technological changes have occurred that allow software development processes that are different from the traditional approaches (i.e., Grand Design, Waterfall). Software development has been enhanced by the availability of automated tools that help define requirements; help design and document the system; generate code; help with configuration management; and make maintenance easier by developing embedded test instrumentation. These procedures can allow for faster production of information systems at less cost.

a. Features of an accelerated software development process (ASDP) include incremental blocks of development and testing; use of a high-level functional description (HLFD) or ORD; user involvement throughout the prototyping process; MS III.C (Certification) of an operationally tested representative sample; MS III.F (Final) which authorizes fielding of the final block; and milestone decision reviews delegations to Project Boards.

b. The procedures outlined in this section offer an alternative to the standard process described in Chapter 5 for small to medium information systems (i.e., classes III and lower).

6-30. Accelerated Software Development Strategy

This paragraph briefly outlines the life cycle management model

for the ASDP, and discusses the T&E activities related to each phase of the model. A comparison of this strategy with the standard strategy described in Chapter 5 can be helpful in understanding the mechanism of the ASDP.

a. Determination of the Mission Need.

(1) Acquisition activities. Activities to be completed prior to Milestone 0 are outlined below. These actions will culminate in a defined mission need and produce the MNS.

(a) Identification of a need by means of completion of an Information Requirements Study, modeling of the business processes, or identifying requirements through the operation of existing systems or processes.

(b) Evaluation of the identified need is evaluated to determine if it can be satisfied by a nondevelopmental solution, such as changes in doctrine, operational concepts, training, or organization.

(c) An initial evaluation of the resources required to develop a solution. The preferred method would be through a Functional Economic Analysis (FEA). The FEA does not replace the Economic Analysis (EA) required after Milestone 0.

(2) T&E and CE Activities. Typically no T&E or CE activities are conducted in this phase.

(3) Milestone 0 (Concept Studies Decision). Approval of the MNS is required by this milestone.

b. Concept Exploration and Definition.

(1) Acquisition activities. Activities to be completed prior to Milestone I are outlined below. These actions will culminate in a coordinated strategy to satisfy the mission need and will produce the HLFD.

(a) Evaluate alternative technical concepts and analyze the technical risks to ensure that alternative system design concepts adequately reflect a broad segment of the technology base and provide an acceptable competitive environment.

(b) Development of an initial EA.

(c) Development of the AS.

(2) T&E and CE Activities. Typically no developmental or operational testing is conducted. The TIWG is established in this phase by the PM (See Chapter 5). CE activities include participation in the development of the HLFD, the preliminary TEMP, and associated documents such as training plans, the SMMP, and the ILSP.

(3) Milestone I (Concept Demonstration Decision). T&E-related requirements for this milestone include approval of the HLFD, the initial COIC, the CMFs, and the preliminary TEMP.

c. Demonstration and Validation.

(1) Acquisition activities. Activities to be completed prior to Milestone I are outlined below. These actions will culminate in a demonstration that better defines the critical design characteristics and expected capabilities, that proves that the critical technologies can be incorporated into the system, that the processes are understood and attainable, and that the first incremental block is functional and ready for final development and testing.

(a) Selection and, if necessary, acquisition of the developmental tool set.

(b) Prototyping the system to conform with the HLFD.

(c) Update the system design based on the prototyping, to include trade-offs between software, hardware, firmware, and human factors.

(d) Using the developmental tools and the user's involvement, design block 1.

(e) Update the AS.

(f) Establish a Developmental Baseline.

(g) Completion of the EA for Block 1, to include estimates for the other blocks.

(h) Determination of the membership, and drafting of the charter for the Project Board.

(2) T&E and CE Activities. Typically no developmental or operational testing is conducted prior to MS II. TIWG meetings are held as required. CE activities include participation in updating the HLFD and transitioning it into the FD as the development continues, updating the preliminary TEMP, and updating the associated documents such as training plans, the SMMP, and the ILSP.

(3) Milestone II (Development Decision). MS II approves the detailed design of Block 1 and authorizes both the completion of Block 1 and the start of the development of subsequent blocks as resources become available. Approval of the FD, the COIC update, and the TEMP update are required by this milestone.

d. Development.

(1) Acquisition Activities. Project Board reviews will occur at key points in the development of the blocks of the system to ensure the project is on track. These reviews have been labeled "MS II.X" to keep the terminology consistent. The reviews are not MAISRC-level reviews. As developmental resources are made available, the remaining blocks are prototyped, designed, developed, integrated with previous blocks, and tested. Actions to be completed by Milestone III.C are outlined below. These actions will culminate in the fielding of the representative sample of the system to the Army.

(a) Milestone II.0. A LUT is conducted after the MS II review by the independent operational tester. The LUT is designed to test the target hardware, Commercial Off-the-Shelf (COTS) software, and communications without any application software. This test shall be be conducted before Block 1 is tested on the target system. The Project Board conducts the MS II.0 review.

(b) Milestone II.1. After MS II.0, Block 1 is tested on the target hardware to support MS II.1. Testing should include a software qualification test and a LUT. If Block 1 is not the representative sample, Milestone II.1 will authorize the fielding of Block 1 to the operational testbed. The Project Board conducts the MS II.1 review.

(c) Milestone II.2 through II.N. Each block prior to reaching a representative sample will be tested as in (b) above and reviewed by the Project Board with a MS II.X review. The software qualification test and LUT will examine the functionality of the block and their integration with previously built blocks. This review will authorize the fielding of the block to the testbed. The Project Board conducts the MS II.X reviews.

(d) Milestone III.C (Certification). When the cumulation of the integration of the blocks comprises a representative sample which has tested and evaluated using the MS II.X approach, the system is ready for a MS III.C. MS III.C is the decision point that certifies the completed increments for

fielding Army wide. It determines whether the completed representative sample satisfies the mission and is ready for deployment. MS III.C requires a MAISRC review. Approval by the MAISRC at MS III.C authorizes the expenditure of resources for the deployment of the representative sample and the hardware/communications packages Army wide.

(2) T&E and CE Activities. The independent operational evaluator will conduct an IOT of the representative sample to support MS III.C. Extensive use of simulation and emulation may be required to fully stress the target configuration. The object of the "fully stress" requirement is to ensure that, as additional blocks are added beyond the representative sample, the system will continue to function without adverse impacts on the user and without the need for expensive hardware upgrades. Test plans, test reports, evaluations and assessments will be prepared by the independent developmental and operational testers and evaluators (See Chapter 5) to support the T&E during development. The evaluations and assessments will be provided to the Project Board and MAISRC as required. CE activities also include participation in the TEMP update for MS III.C and associated documents such as training plans, the SMMP, and the ILSP.

e. Production and Deployment.

(1) Acquisition Activities. This phase begins with MS III.C and ends with MS III.F (Final). MS III.F will approve fielding the final block of the system. The blocks completed after MS III.C will be reviewed by the Project Board prior to fielding. The reviews associated with these blocks will be designated as MS III.1 through III.M until the final block is ready for fielding. Because the representative sample has been fielded Army wide, MS III.1 would authorize Army wide fielding of the first block completed after MS III.C.

(2) T&E and CE Activities. These activities are similiar to those discussed in the MS.II.X sequence. The independent operational evaluator will conduct an IOT of the final block of the system to support MS III.F. CE activities also include participation in the TEMP update for MS III.C and associated documents such as training plans, the SMMP, and the ILSP.

(3) Milestone III.F (Final). MS III.F is the MAISRC review that determines that the final block is complete, the total system is complete, the system satisfies the mission need, and the system is operationally effective and suitable. This milestone marks the transition of the system to operations and support.

f. Operations and Support. Following MS III.C, the fielded blocks are in the operations and support phase. The entire system transitions to operations and support after MS III.F. The acquisition process, T&E, and CE activities from this point forward are similar to the standard process (See Chapter 5).

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Chapter 7
Test and Evaluation in Support of Systems Modernization

7-1. General

a. In 1990, the Army changed the process for managing modifications to developed materiels. Previously, Product Improvement Proposals (PIPs) on fielded materiel were submitted by the system manager to HQDA for approval, while Engineering Change Proposals (ECPs) were initiated and approved by field level engineering organizations. The result was, in many cases, significant scrutiny of routine PIPs on one hand, and minimal scrutiny to ECPs that had dramatic impact on costs and field usage on the other. New procedures were implemented to bring both ECPs and PIPs under one process.

b. Modification encompasses all hardware, firmware, and software changes except Class II ECPs, to materiel Type Classified Standard, LRP, and LPU, and provides a single comprehensive process to manage modifications. Complete details on the Modification process are contained in the "Interim Operating Instructions for US Army Materiel Change Management", dated 6 September 1990.

c. All system modifications must undergo evaluation, and most will require testing also. T&E is conducted to assure that the modification achieves the desired effect without degrading performance, reliability, safety, or system logistical characteristics.

d. In order to allow a reduced level of T&E effort on modifications that do not effect system performance or the user in any substantive way, an abbreviated T&E process has been developed that eliminates the need for TIWGs, TEMPs and Independent Evaluations. The intent is to provide a level of T&E effort commensurate with risk, recognizing that some modifications represent minimal risk. Most modification efforts will require compliance with the "conventional" T&E process as described throughout this Pamphlet; however, if the criteria described in this chapter are met, the abbreviated process can be utilized.

e. The term "program sponsor" is used to indicate the actual manager of the modification effort. The program sponsor could be a PM or a Project Officer for systems that have not transitioned into production, or the item manager for developed systems. Modifications to systems that have transitioned into production but that require a significant effort may be assigned to a

PM/MATDEV for development/implementation. In these cases, the initial activities of the Modification effort will be conducted by the item manager until assignment of a PM/MATDEV.

7-2. System Modification Requirements

a. The modification process currently in effect within the Army has four "program" levels as follows:

(1) Modifications with the Configuration Control Board (CCB) or Configuration Manager (CM) as the decision authority.

(2) Modifications with the program sponsor as the decision authority.

(3) Modifications with PEOs/MSCs as decision authority.

(4) Modifications with the AAE as decision authority.

b. All modifications with the CCB/CM as decision authority can use the abbreviated T&E process as described below. All Modifications with the PEO/MSC or AAE as the decision authority must conduct a conventional T&E program as outlined in this Pamphlet. Modifications with the program sponsor as the decision authority must determine if the abbreviated process can be used as follows:

(1) Total estimated budgetary cost of less than $5M.

(2) No retrofit by MWO is required.

(3) No change in operational capability/No critical Operational Issues & criteria (COIC).

(4) No change in program cost/schedule/performance baseline.

(5) No high level interest (i.e., DOD, congress).

(6) No safety related change to system.

(7) Not a Class I software change IAW DOD STD-2167.

c. Exceeding any of the criteria listed in the abbreviated TEMP will require a Test Integration and Working Group (TIWG) to be convened. The TIWG will determine details and amount of developmental and operational testing required for the modification. The TIWG members will tailor the TEMP to the

specific modification under consideration. Specific guidance for the TEMP format is contained in DOD 5000.2M, Part 7.

d. It is essential that the MATDEV involve the T&E community early on in the modification process. The results of the T&E will be used by the independent developmental evaluator, operational evaluator and logistician to render assessments supporting or opposing the production decision of the modification. Additionally, the evaluators will use the T&E information gathered to render opinions on materiel release of the modification.

e. Testing consolidation. To achieve maximum T&E efficiencies, testing of multiple modifications into a single system/end item is encouraged. This process should be planned thoroughly early in the modification process. One comprehensive TEMP should integrate as many minor changes as possible.

(1) The program sponsor completes the "Combat Developer Coordination Checksheet" listed at Figure 7-1, and forwards the completed checksheet along with the Modification data package to the Combat Developer for review.

(2) The combat developer, upon completion of this review, must formally notify the program sponsor whether Critical Operational Issues (COI) associated with the modification have been identified.

(3) If the Combat developer does not identify any COI associated with the Modification, the program sponsor can use the abbreviated T&E process as described below. If, however, the Combat Developer identifies COIs, all the requirements outlined in AR 73-1 and this Pamphlet apply, i.e a TIWG must be formed, a TEMP developed, Independent Evaluations must be conducted, etc.

f. The key factor in determining the level of T&E conducted on a modification is the presence or absence of COI as determined by the CBTDEV/Functional Proponent. The Combat Developer Coordination Checksheet is required to be completed on all modification efforts, however for those Modification with the CCB/CMgr as decision authority, no formal coordination with the CBTDEV/Functional Proponent is required.

7-3. Systems Modification TEMPs

a. TEMPs for modification programs should be separate, "stand-alone" documents. Use of the original system's development TEMP is inappropriate, as the modification effort

will have unique operational and technical issues. The TEMP should address only the elements of the parent system that are effected or that have an interface with the modification effort.

b. When several modifications are being conducted on one system, consolidation of the testing effort is desirable. One comprehensive, consolidated TEMP should be prepared outlining the planned T&E, and all data should be shared to ensure maximum efficiency.

7-4. Systems Modification and Post Deployment Software Support (PDSS) Test and Evaluation.

a. Test and evaluation will be conducted on all modifications and Post Deployment Software Support (PDSS). The scope and type of T&E will vary for each Modification/PDSS and will be documented in accordance with this pamphlet.

b. The following criteria will be used to determine the T&E conducted on Modification/PDSS:

(1) Upon initiation of an Modification or PDSS, the program manager will determine if formal coordination with the combat developer or functional proponent is required. When formal coordination is required and the CBTDEV or FP indicates that there are critical operational issues associated with the Modification or PDSS, the program manager will charter a TIWG. The TIWG will determine the type and amount of testing that is required to be performed on the Modification/PDSS. This testing will be documented in the TEMP. The level of program management will be categorized based on the same criteria used for new starts, and the decision authority or TEMP approval process will be consistent with the categorization. An OA/AOA will be prepared by the independent operational evaluator, and a developmental evaluation or assessment report will be prepared to support the decision review for approval of procurement and application.

(2) When the formal coordination with the combat developer or functional proponent is not necessary, or when the combat developer or functional proponent indicates that there are no critical operational issues associated with the Modification or PDSS, T&E will be conducted as appropriate, documented and included in the program manager's package provided at the decision review. A TIWG, a TEMP and an operational evaluation are not required in this case. However, the program manager will consult the MATDEV, Independent Developmental Evaluator or Assessor, to determine if coordination is required with the

independent developmental evaluator or assessor. When coordination is required, an independent developmental evaluation or assessment will be performed unless waived by the independent developmental evaluator or assessor. Waiver of the requirement for a developmental evaluation/assessment may occur if the checksheet indicates that coordination is not required or if the developmental evaluator/assessor, after review of the package, determines that evaluation or assessment is not needed. In this case, formal notification to the program manager will be made by the independent developmental evaluator/assessor.

c. When a block modification is being tested or when testing for more than one Modification or type of PDSS is actively being conducted on a system, and are planned to be integrated into the same end item, efforts will be integrated so that maximum T&E efficiencies are achieved. One TEMP (in those cases where a TEMP is required) shall be prepared integrating the T&E required into one comprehensive master plan. The TIWG members shall plan and conduct T&E so that maximum efficiencies in assessing specific aspects of the various Modification/PDSS can be achieved. In cases where integration is not practical (e.g., different program manager agencies), every effort shall be made to assure that system integration testing of all Modification/PDSS is performed.

d. Test and evaluation of modifications and PDSS require both developmental and operational testing. The purpose of this testing is to determine the viability and adequacy of the change and to determine if the change was achieved without degradation to the system, other components, or interface equipment. Modification involves reconfiguration of a fielded item to provide new or enhanced capability, extend the useful life of the system, improve safety or readiness, or reduce operation support cost. Modifications includes Product Improvement Programs (PIPs) which are not preplanned.

e. Modifications are normally necessitated because some development (e.g, technological breakthrough, doctrinal change, revised threat estimate) has occurred after the original system configuration was fixed. Documentation and testing are reduced from new system development, as are milestone reviews, because both documents and decision issues are focused on the areas of change. Generally, if the performance envelope changes significantly, requirements documents are required, and the associated TEMP and OT&E cycles apply. However, if the modification is focused only on reduced operating costs, minimal operational testing is performed to ensure no degradation of overall system performance. The independent operational evaluator must draw upon military expertise, materiel acquisition

knowledge, and current Army policy to make a recommendation to the TIWG. The evaluator, in coordination with the ODCSOPS staff officer, informs DOTE of the modification if the system has been designated for DOTE oversight.

f. The product of T&E is information which Army/DOD leadership needs to make informed decisions. Testing involves costs in terms of time, resources and effort. The primary reason for testing is to obtain information which is unknown and can only be learned by testing. Evaluation is a continuous process which will be accomplished on all modifications. In this light, testing and evaluation of modifications will be tailored to the specific system requiring modification. The extent and type of T&E varies for each modification. Testing and evaluation will be performed and documented in accordance with DOD 5000 series guidance, AR 73-1, AR 70-1 and other applicable T&E guidance.

g. The purpose of developmental T&E is to determine the safety, viability and adequacy of the modification and to determine if performance, system and critical technical parameters objectives for the modification have been met. The purpose of operational testing and evaluation is to determine if the modification is operationally effective and suitable for use. Both developmental and operational T&E results may be used to ensure that the proposed modification is cost effective and economical relative to other alternatives.

h. Several factors will determine the extent of T&E which will be required for a modification. To determine the degree of T&E needed. An abbreviated T&E procedure normally requires no testing and limited evaluation. The following criteria will be used to determine requirements for abbreviated T&E of modifications.

(1) When a program sponsor has determined that the abbreviated T&E process can be used, the TIWG, TEMP and inependent operational evaluation can be omitted.

(2) An independent developmental evaluation or assessment may be required for modifications utilizing the abbreviated T&E process. The criteria used to establish the need for an independent developmental evaluation is as follows:

(a) The program sponsor completes the "Program Sponsor & Independent Developmental Evaluator/Assessor Coordination Checksheet" listed at Figure 7-2. If the answer to any question on the checksheet is "NO", then formal coordination with the independent developmental evaluator and a independent

developmental evaluation are not required.

(b) If the answer to any question on the checksheet is "YES" or "MAYBE" then the program sponsor must send a complete modification data package to the independent developmental evaluator. Upon receipt of the Modification Data Package the independent developmental evaluator will perform a review and make a determination whether the modification should have an independent developmental evaluation. This determination should be made considering such factors as risk associated with the technology, safety, environmental issues, impact on survivability/vulnerability, MANPRINT concerns, or any other factor that the independent developmental evaluator considers appropriate.

(c) The independent developmental evaluator will provide formal notification to the program sponsor informing him whether an evaluation will be performed.

(d) When the independent developmental evaluator determines that an evaluation is required, an IEP shall be prepared outlining the required testing and evaluation by the independent developmental evaluator, and a copy of the IEP should be provided to the program sponsor to facilitate program planning. The need for an evaluation, however, does not necessarily mean that testing also is required. An evaluation of existing data can be performed or, alternatively, dedicated testing may be required to address the technical concerns.

7-5. Post Deployment Software Support (PDSS) Requirements

a. Software changes to deployed systems are generated because of latent defects, doctrinal requirements, threat changes, weapon/munitions upgrades, interoperability requirements, product improvements and new system functions. Change requests are normally generated by the using agency, CBTDEV, or Functional Proponent and forwarded for approval, prioritization and implementation. Changes are generated in accordance with AR 25-3, AR 71-9, and DA Pamphlet 25-6.

b. Emergency changes frequently need to be released to the field within 48 hours. In this case, the T&E team needs to respond quickly to ensure that the software changes are made and adequately retested. Because changing software to fix a problem can introduce additional problems, retesting must be done along with testing the fix. It is permissible for formal documentation updates to catch up later. All changes to the software must be identified and controlled by the configuration management

function.

c. While all changes for systems under development must undergo validation and verification testing, emergency changes to deployed systems may not require formal developmental testing or operational testing. However, all emergency changes will undergo formal testing with the next planned updates. The system or operation manager, with the concurrence of the system user, may only be capable of performing limited testing of emergency software corrections prior to granting release.

7-6. Post Deployment Software Support (PDSS) Test and Evaluation

a. PDSS consists of modifications and maintenance of software in fielded systems or systems to be fielded after MS III decision. The development of a change follows the basic life cycle process as a new system; however, the scope and resources involved may be reduced. The PDSS environment generally produces many small changes over a period of time rather than a few large changes. The PDSS organization must be able to coordinate and phase-in these many changes into a few formal software releases to minimize disruption of fielded systems. Differences in the magnitude and timing of software changes must be considered in identifying the scope of T&E required and the extent of T&E team involvement. The concept of block changes and block releases must be integrated into the T&E planning.

b. PDSS test and evaluation refers to changes made to the system after first unit equipped (FUE) or first site fielded. These changes are within the authority of the system manager or MATDEV. Test and evaluation of changes during PDSS and software development activities are contained in Part Seven.

c. PDSS requires some flexibility in development, testing, and evaluation, in order to respond to the changing environment. Often, new requirements have date-driven implementation milestones which must be accommodated to preclude adverse impact on system performance. Emergency changes which must be completed within 48 hours may be required. The T&E team must be responsive and is an integral element of effective PDSS support and fielding of quality products.

1. This checksheet is to be used by the Program Sponsor to determine if coordination with the CBTDEV/Functional Proponent is required. The purpose of the checksheet is to provide a simplified method of determining whether a proposed MC has CBTDEV/Functional Proponent impact/interest in order to ease the administrative burden of coordination between the Program Sponsor and CBTDEV/Functional Proponent.

2. The checksheet determines whether CBTDEV/Functional Proponent interest is present, based on evaluation of the following conditions regarding the proposed MC:

a. Implementation of the proposed change affects the execution of another funded program or requires competition in the PPBES to acquire funding.

b. Calls for changes to the existing performance capability of the system beyond the bounds of the existing requirements document as amended by subsequent decisions.

c. Affects the BOIP, QQPRI, or TO&Es associated with the system.

d. Affects the way the system Is operated, employed and maintained.

e. Alters MANPRINT requirements (manpower, personnel, training, human factors engineering, system safety, health hazards).

f. Has safety implications.

3. The Program Sponsor or his designated representative is responsible for evaluating the change against the checksheet, answering its questions, and verifying its correctness by providing the information required and signing at the bottom. The form is then enclosed in the MC package.

4. If any of the questions on the checksheet can be answered "YES or "MAYBE", then the entire MC package must be coordinated with the CBTDEV/Functional Proponent prior to implementation of the MC. Conversely, if all the checksheet questions can be answered "NO", CBTDEV/Functional Proponent concurrence is necessary only for those MCs which require Program Sponsor level approval or higher.

5. The following is additional guidance concerning answering the

Figure 7-1 Combat Development/Functional Proponent Coordination Checklist

checksheet questions.

a. Answer each question "YES", "NO", or "MAYBE."

b. Use of the "MAYBE" answer is appropriate if there is doubt that the answer is clearly "YES" or "NO".

c. Consult AR 73-1, Testing and Evaluation, for any clarification of question "a".

d. Consult the MNS, ORD, or other basic requirements document for the system in answering question "b".

e. Questions -d" through "h" are derived from requirements found in AR 71-2, BOIP/QQPRI and also have MANPRINT implications.

f. Local reproduction of the checksheet is authorized.

6. Discussions between the Program Sponsor and CBTDEV/Functional Proponent representatives are encouraged to prevent the checklist from unnecessarily elevating the decision level of an MC. Any agreements to retain the MC at a lower decision level will be recorded by the Program Sponsor and become part of the MC file. Would application of this MC proposal to the system/end item--

a. Require some form of user testing (As opposed to durability or reliability testing)? (YES_____NO____MAYBE_____)

b. Require funding diversions which will impact the performance/completion of other funded aspects of this or other programs, or rely on successful competition for funds not currently programed? (YES____NO____MAYBE____)

c. Affect the system's operational characteristics, performance, or tactical employment in a way which will impact the user? (Example -- weight, speed, rate of climb or acceleration, transportability, lethality, center of gravity)? (YES____NO____MAYBE____)

d. Alter the number or type of supporting equipment for this system, including Associated Support Items of Equipment (ASIOE) or Test, Measurement, and Diagnostic Equipment (TMDE)? (YES____NO____MAYBE____)

e. Alter the number or type (require a new or different MOS) of crew and/or support personnel required to operate or maintain the equipment, or require the formulation of additional

Figure 7-1 Combat Development/Functional Proponent Coordination Checklist

operational or support units? (YES____NO____MAYBE____)

f. Affect human factors which will alter internal operating procedures or skills with the system to such a degree that training/operating instructions for operators or field operations must be changed? (Examples, adding a radar warning system or changing gunnery procedure). (YES____NO____MAYBE____)

g. Alter the maintenance procedures with regard to time and equipment required, disassembly/assembly sequence and/or trouble shooting instructions to such a degree that training/operating instructions for maintainers must be changed? (YES____NO____MAYBE____)

h. Require corresponding changes to simulators or training devices for the system, or vice versa? (YES____NO____MAYBE____)

i. Have safety implications (i.e., correct and existing safety problem or create a potential safety problem)? (YES____NO___MAYBE____)

ACTIVITY______________________SIGNATURE__________________________

DSN________________PRINTED NAME & RANK__________________________

(Provide explanatory comments, as required).

Figure 7-1 Combat Development/Functional Proponent Coordination Checklist

1. This checksheet will the Program Sponsor in determining whether an MC proposal requires formal coordination with the Independent Developmental Evaluator/Assessor (IDE/A). If the answer to any question is "YES" or "MAYBE", the Program Sponsor must send a complete MC package to the IDE/A so that the need to conduct a formal evaluation/assessment, system safety confirmation, and developmental test planning can be determined. If all answers are "NO", formal coordination is not required.

2. Would approving this change to the system/end item :

a. Significantly alter the technical characteristics of the system/end item. (YES____NO____MAYBE____)

b. Affect the systems developmental characteristics or performance or alter the performance of a subsystem.
(YES____ NO ____MAYBE____)

c. Employ new or not fully proven technology.
(YES____NO____ MAYBE____)

d. Affect RAM characteristics of the system/end item.
(YES____NO____MAYBE____)

e. Affect the survivability or vulnerability of the system or end item. (YES____NO____MAYBE____)

f. Have safety implications (i.e., correct an existing problem or create a potential safety problem).
(YES____ NO____MAYBE____)

g. Impact other MANPRINT considerations (manpower, personnel, training, HFE, health hazards).
(YES ____NO____ MAYBE____)

h. Effect the environment. (YES____ NO____ MAYBE____)

Figure 7-2 Program Sponsor and Independent Evaluation/ Assessor Coordination Checksheet

Chapter 8
Test Integration Working Group

Section I
Introduction

8-1. General
The TIWG has been established as the forum to effect coordination and solve routine problems in the Test and Evaluation process. By bringing together the many agencies involved in the T&E process, the TIWG chairman can brief the current status of the program, the future events that will take place, and emphasize the work that must be done by which agencies to ensure that a well orchestrated T&E program is being conducted.

8-2. TIWG Team
The TIWG is a team of highly qualified members representing their respective organizations who meet to plan the necessary testing and the attendant evaluations. Through the intense efforts of this team the planning, scheduling, resourcing, and actual testing can be accomplished. The team effort establishes a T&E program that will address whether the risks of developing and producing required systems are within acceptable and safe parameters. Actual testing or the availability of existing and directly applicable test data will assure that all technical and operational characteristics and issues are measured or assessed as comprehensively as possible.

8-3. Purpose
The primary purposes of the TIWG are to optimize the use of appropriate T&E expertise, instrumentation, targets, facilities, simulations, and models to implement test integration, thereby reducing costs to the Army; integrate test requirements; concur in the TEMP as the first step in the TEMP approval process; mutually resolve cost and scheduling problems; provide a forum to assist those responsible for T&E documentation and execution: and ensure that T&E planning, execution, and reporting are directed toward common goals.

8-4. Goals
TIWG goals are to develop a mutually agreeable test program that will provide the necessary test data for evaluations; to provide for development, staffing, coordination and approval of all required T&E documentation; establish the necessary subordinate working groups (subgroups) to address related T&E issues; assure all participants have the opportunity to be involved and not be

excluded; establish and manage the corrective action process; participate in technical and operational test readiness reviews (TTRR and OTRR) and to support the continuous evaluation (CE) and integrated T&E.

Section II
Objectives

8-5. TIWG Forum
TIWGs provide a forum in which designated representatives of each member organization can discuss freely their test requirements; mutually resolve cost and scheduling problems; and assure that T&E planning, execution, and reporting are directed towards a common goal. T&E coordination among all members of the acquisition team (AT) is accomplished through the TIWG. To this end, TIWG members are members of the AT and remain a principal active working group throughout the system acquisition process.

8-6. TIWG Meetings
TIWG meetings encompass activities such as: the airing of substantive developmental and operational issues; briefings by special interest activities (e.g., safety, environmental, software); coordination of schedules, test plans, Test & Evaluation Master Plan (TEMP), etc.; and identification of problems and resolution of issues.

8-7. The TIWG Charter
The TIWG is chartered to perform the function of structuring the test and evaluation (T&E) program and integrating the various T&E and data requirements. It is chaired by the PM/MATDEV and is constituted of qualified T&E representatives, with the authority to speak and sign for their parent organization. TIWG members are obligated to participate in TIWG meetings unless the agenda does not include topics where they have a direct interest.

8-8. Establishment of the TIWG
The TIWG is established prior to Milestone I (MS I) by the PM/MATDEV (or appropriate acquisition team if the PM is not designated) after receipt of the approved Mission Need Statement (MNS). This will be in sufficient time to assist in finalizing the critical operational issues and criteria for decision authority approval at MS I, and will facilitate early development of the TEMP and the T&E portions of the Request for Proposal (RFP) and supporting documentation. Close coordination among the TIWG members must be effected in a timely manner in order to optimize schedules and costs and preclude duplication or voids in

the acquisition test cycle.

8-9. CE
The TIWG supports continuous evaluation (CE) by accomplishing earlier, more detailed, and continuing T&E documentation, planning, integration, and sharing of data from all testing. T&E documentation should, if possible, not be published without first allowing the principal TIWG members to review (not necessarily with any form of approval authority) the document thoroughly. This process will ensure that accurate T&E documentation will be published.

8-10. TIWG Members
TIWG members ensure transmittal and review of test incidents and related reports, described in Chapter 17.

Section III
Composition

8-11. TIWG Participants
The TIWG is divided into two categories of participants, "principal" and "associate" members. TIWGs are chaired by a PM representative. Generally, the TIWG consists of the following principal members:

a. PM/MATDEV

b. Combat Developer/Functional Proponent, TRADOC for AR 70 systems, any MACOM or DA staff section for AR 25 systems.

c. Developmental Tester, TECOM for AR 70 systems and TECOM, ISEC, or AMC/AMC MSC for AR 25 systems.

d. Developmental Independent Evaluator/Assessor, AMSAA or TECOM for AR 70 systems and AMSAA, TECOM or ISEC for AR 25 systems.

e. Operational Tester, TEXCOM for AR 70 systems and TEXCOM, INSCOM, any MACOM or ISC/ISEC for AR 25 Systems.

f. Operational Independent Evaluator, OEC for both AR 70 and 25 systems.

g. Logistician, AMSAA for AR 70 systems and AMSAA or the Developmental IE for AR 25 systems.

h. Survivability/Lethality Analysis Directorate (SLAD). Responsible for determining the survivability/lethality and vulnerability (SLV) of Army systems to the full spectrum of battlefield threats.

i. Threat Integrator, Threat Systems Officer (TSO) from the TRADOC school initiating the requirement for AR 70 systems. A threat integrator is generally required for theater/tactical AR 25 systems. The threat integrator is a principal member of the TIWG only when the system being acquired is intended to defeat a specific threat system/s.

j. Trainer. The trainer is a principal member of the TIWG only when the CBTDEV is a separate agency from that which will be providing training for the program, e.g. Special Operations Forces is the CBTDEV, Army Infantry School is the Trainer.

8-12. Other TIWG Members
Additional agencies which can be principal members of the TIWG include:

a. The Army Command Control System (ACCS) systems engineer for any ACCS component system or equipment which has one or more interfaces.

b. The PM Smoke/Obscurants for all systems which rely on electro-optical propagation and are susceptible to aerosol countermeasures.

c. Military Traffic Management Command Transportation Engineering Agency if transportability engineering analysis of "problem items," in accordance with AR 70-47, has identified any transportability issues.

d. Joint Tactical Communications, Command, and Control Agency for tactical C3 intelligence systems.

e. U. S. Army Defense Ammunition Center and School (USADACS) when ammunition restraint system procedures need to be developed for military vehicles so that appropriate testing can be performed on design tiedown points.

f. PMs/MATDEVs from other programs that are being developed concurrently as part of a single system. This can occur when two vehicles or major subsystems are being developed concurrently by two different organizations as part of one program.

g. Representatives from the Army Research Laboratory (ARL).

h. Representatives of other services for multiservice acquisitions.

8-13. TIWG Associated Members
The associate members of the TIWG may consist of any representative who provides a needed supportive role to adequately address all necessary T&E requirements, and support the subordinated working groups. These associate members can include the Integrated Logistics Management Support Team (ILSMT), the international materiel evaluation representative, the contractor (when appropriate), PM Instrumentation, Targets and Threat Simulators (ITTS), and those commands/activities which serve in a monitor's role (e.g., The Surgeon General (TSG) representative for health aspects associated with system testing/use.

8-14. PM/MATDEV
The PM/MATDEV will make the initial determination of the TIWG members which will be, at a minimum, those members identified in paragraph 8-9.

8-15. Multiservice Acquisition Programs
Multiservice Acquisition Programs with Army lead will have the same Army TIWG membership as an Army unique acquisition program. Participating services will determine their membership requirements and those will be documented in the TIWG charter. Multiservice programs with Army participation (not lead) will have, as a minimum, representatives from the PM/MATDEV, CBTDEV/Functional Proponent, TIE, and IOE. If any Army unique testing is planned, the appropriate test agency shall also be represented. As in all cases, TIWG membership is documented in the Charter.

Section IV
TIWG Subgroups

8-16. TIWG Subgroups
Essential to the TIWG process is the performance of specialized tasks assigned to subordinate working groups. The subgroups are necessary to define the details of the T&E program, handle the interfaces with other disciplines, prepare for testing, and develop supporting T&E documentation. Additionally, the subgroups are required to coordinate and jointly develop T&E parameters and identify corrective actions. When possible the T&E charter will delineate the planned subgroups. In some cases

the subgroups may need to establish their own work groups.

8-17. TIWG Subgroup Charters
The TIWG will charter, as necessary, the subgroups identified below. Other subgroups may be chartered as appropriate.

a. RAM Working Group (RAMWG). Co-chaired by the MATDEV and CBTDEV, this group will address all RAM issues including failure definition/scoring criteria, RAM Rationale Annex, and Data Collection. The technical and operational evaluators, as a minimum, participate in this subgroup. Further details of this subgroup are contained in AR 702-3.

b. The Supportability T&E Working Group (STEWG) Subgroup is chaired by the PM/MATDEV ILS manager. The purpose of this subgroup is to provide coordination of the TIWG activities with the Integrated Logistic Support Management Team (ILSMT). Topics to be coordinated will include all supportability test issues, test requirements, and logistic demonstration requirements contained in the TEMP. Further details of this subgroup are Contained in AR 700-127.

Section V
Interface Groups

8-18. Other Working Groups
There are many related disciplines which have a close tie with the TIWG and their working group activities occur concurrently and often combined with the activities of the TIWG. The communication lines between these groups with the TIWG must be clear and allow for the transfer of information to enhance the progression of work for all disciplines. Some of these closely related subgroups are as follows:

a. The Threat Coordinating Subgroup is chaired by the threat integrator member of the TIWG. The purpose of this subgroup is to develop, coordinate and maintain Threat Test Support Package (TTSP).

b. Operational Test Readiness Review Working Group (OTRRWG). The OTRRWG evaluates the system's readiness to enter OT. Membership includes the PM/MATDEV, OT, and IOE. For additional information on the OTRRWG, see Part V of this Pamphlet.

c. Developmental Test Readiness Review Working Group (DTRRWG). The DTRRWG evaluates the system's readiness to enter

developmental test. Membership includes the PM/MATDEV, DT and Developmental Independent Evaluator (DIE). For additional information on the DTRRWG, see Part IV of this Pamphlet.

d. Data Authentication Group (DAG). Data Authentication Group (DAG). The operational tester determines the need for a DAG. The DAG is chaired by the operational tester with representatives from required areas of expertise in attendance. It meets while tests are being conducted to ensure timely exchange of data among all participating agencies/commands and to build a factual data base by assisting in data reduction, data analysis, and the investigation of problems surfaced in test data. The group is formed when the evaluation of systems require complex data collection/instrumentation. Its members may also comprise the membership of the RAM scoring and assessment conferences, and the DAG functions may be conducted concurrently with those of the other two conferences when appropriate. Composition of the DAG for an OT is included in its OTP. For additional information on the DAG, see Part V of this Pamphlet.

e. Computer Resources Working Group (CRWG). The CRWG is established by the PM/MATDEV after MS I for each AR 70-1 system to aid in the management of system computer resources. The CRWG assists in ensuring compliance with policy, procedures, plans and standards established for computer resources. Membership includes CBTDEV, MATDEV, Developmental and Operational testers, DIE, IOE and the post deployment software support activity. Members will actively participate in all aspects of the program including computer resources. For additional information on the CRWG see Part VI of this Pamphlet.

f. Integrated Logistics Support Management Team (ILSMT). The ILSMT is established to coordinate overall ILS planning and execution. Membership includes the PM/MATDEV, DT, OT, DIE, IOE, Logistician and Trainer. (SEE AR 700-127)

g. MANPRINT Joint Working Group (MJWG). The MJWG develops the System MANPRINT Management Plan (SMMP) and coordinates the MANPRINT program. Membership includes the PM/MATDEV, CBTDEV, Logistician and other organizations as appropriate. (SEE AR 602-2)

h. System Safety Working Group (SSWG). The SSWG is chaired by the PM/MATDEV and provides program management with system safety expertise and ensures enhance communication between all AT members. Membership includes the PM/MATDEV, DT, OT, DIE, and IOE. (SEE AR 385-16)

i. Live Fire Test and Evaluation Working Group (LFT&EWG). The LFT&EWG is chaired by AMSAA and is formed to prepare the LFT&E strategy and input to the TEMP. Membership typically includes the system developer, the combat developer, the independent evaluators, vulnerability/lethality analysts, testers, the medical community, the intelligence community and the system contractor (as required).

Section VI
Charter

8-19. A charter is required for each TIWG
The charter establishes the membership, scope, objectives and procedures of each TIWG. A sample format is at Figure 8-1. The formal TIWG Charter is prepared by the PM/MATDEV and coordinated with the principal TIWG members.

(insert Figure 8-1)

Section VII
Meetings

8-20. Initial TIWG
The initial TIWG meeting should be held, possibly in conjunction with a review of the draft Operational Requirements Document (ORD) or IMA system requirements document, to familiarize the TIWG members with the preliminary system requirements. This meeting can be used to support the PM in developing the T&E strategy for incorporation into the acquisition strategy, to identify all required TIWG members, finalize the charter and task TIWG members to prepare input for the preliminary TEMP. Initial draft input should be submitted to the PM within 30 calendar days.

8-21. Notice of TIWG Meeting
Notice of the initial TIWG meeting should be sent at least 14 calendar days (2 weeks), preferably 30 days, prior to the TIWG. A draft agenda should accompany the notice. The agenda should be finalized with input solicited from the TIWG members.

8-22. Strawman TEMP
When circumstances warrant (e.g., accelerated acquisition), a strawman TEMP can be prepared by the PM for review and discussion at the initial TIWG. The strawman TEMP should be provided to the TIWG members at least 30 days prior to the meeting. A strawman TEMP can be used to facilitate T&E strategy discussions and

development of the preliminary TEMP.

8-23. TIWG Topics
Topics which need to be addressed at the initial TIWG include:

a. Introduction to the program. At the initial TIWG, it is very likely that attendees will be unfamiliar with a new program and it is necessary to familiarize them with all aspects of the new system.

b. Acquisition strategy. Describe the overall acquisition approach that will be employed, showing how the results of the T&E communities participation in the early planning of the acquisition strategy ensures adequate T&E is integrated into the overall program.

c. Requirements documents. Conduct a detailed review of the Mission Need Statement (MNS) and the draft ORD or functional description if available. This is to familiarize the TIWG members with the requirements for the new or modified system. The Combat Developer or the Functional Proponent, in the case of IMA systems, should conduct the review.

d. T&E provisions in contracts. Generally, contractual documentation has not been prepared at this point, however it is important to stress that a major function of the TIWG members is to review contractual documents for T&E adequacy. If there is a draft Statement of Work (SOW) or Request for Proposal (RFP), it is useful to highlight the contractual requirements for test and evaluation.

e. Strawman TEMP review. If a strawman TEMP is prepared prior to the initial TIWG, time should be allotted at the TIWG to review all comments and proposed changes to the TEMP. If the changes are satisfactory to the TIWG members, the TIWG Coordination Sheet can be signed at the meeting site, or alternatively, signed within some time frame that is mutually agreeable to all principal TIWG members.

8-24. TIWG Actions
At the first TIWG the following actions should occur:

a. Provide a program/system orientation briefing.

b. Review available system requirements documents to familiarize TIWG members with preliminary system requirements.

c. Develop the T&E strategy for incorporation into the

acquisition strategy.

d. Initiate dialogue to define the technical and operational issues to be addressed in T&E.

e. Detail the initial test requirements for the respective life cycle phases that will provide the test data and evaluations needed for each milestone.

f. Task TIWG members to draft their respective portions of the TEMP if a strawman is not provided. If a strawman was prepared, TIWG member comments and recommended changes should be discussed. Agreement should be reached on changes to be made and issues to be resolved.

g. Review and approve the TIWG charter. Ensure all TIWG members are identified.

h. Establish required subgroups.

i. Discuss initial document development requirements. Immediate work should proceed to develop the Critical Operational Issues and Criteria (COIC), the Safety Assessment Report (SAR), the Security Classification Guide (SCG), Safety Release (SR), and Environmental Impact Statements (EIS). Completion of this documentation facilitates the test process.

j. Discuss the action items assigned and develop a tentative agenda for the next meeting.

k. Record the minutes and action items. After the meeting the Chair will prepare the meeting minutes including the Action Item List (AIL), and distribute as agreed to at the meeting and in the TIWG charter.

l. Establish the TIWG minutes distribution list containing all pertinent information, e.g. actual names, phone numbers, facsimile numbers, and electronic addresses.

8-25. Follow-on Meetings
Follow-on TIWG meetings should occur on a timely basis to continue the T&E planning effort and the development, coordination, and approval of the required T&E documentation, especially, the TEMP. The progress of the test program will be addressed and subgroups will meet as appropriate. As program changes occur and testing details are developed, program planning modifications will be required. Discussion of issues should continually occur, and issues which are resolved will be closed

out in the AIL. DTRRs and OTRRs will be conducted and any issues relating to test readiness should be raised and resolved at the TIWG. Techniques for data collection, incident reporting and other test peculiar issues should be fully coordinated and integrated within the T&E community. A TIWG can be held at any time in a program when it is necessary to assemble the many agencies involved in the T&E process for the program. This can occur when the program is restructured, when an event presents a serious conflict for the next series of tests, during a test to disseminate information, or any other time.

Section VIII
General TIWG Procedures

8-26. TIWG Meeting
Announcements for a TIWG must be sent to all TIWG members at least 14 days, preferably 30 days, prior to the commencement of a TIWG. The notice announcing the TIWG should include an agenda of topics to be discussed that includes TIWG member topics.

8-27. Unresolved Issues
The TIWG should not submerge the airing of substantive developmental and operational issues by a consensus process. Disagreement on matters of substance will be elevated through command channels to the next higher level for review and adjudication. Issues not resolved will be brought to the DUSA(OR) for resolution. Policy and procedural issues should be brought forward through TEMA for DUSA(OR) resolution.

8-28. Open Items
When an agenda item is not completed or resolved during a TIWG meeting, it is usually assigned to one of the representatives (contingent upon acceptance) for action, with appropriate suspense date. Open action items become part of the TIWG Action Item List (AIL) and are carried over to the next TIWG agenda either to verify that action has been completed or accomplish the necessary closing action. The action items should be briefed as the last agenda topic at the TIWG.

8-29. TIWG Minutes
Minutes of each meeting are prepared by the chairperson and distributed to each principal member (to include those who could not attend) within 10 working days of the TIWG meeting. The minutes document all decisions and agreements of the TIWG and become a part of the official file. If the minutes do not adequately reflect a member's understanding of what was

accomplished at a TIWG meeting, or if a member organization's position changes, this should be brought to the attention of the chairman for correction or added as an action item to the next TIWG agenda within 2 weeks after receipt of the minutes. Alternatively, any reasonable period of time, as agreed to by all TIWG members and documented in the Charter, can be used.

8-30. Teleconferences

Consideration should be given to conducting limited scope TIWG meetings by video teleconference. Normally conference time is limited to 2 hours. This method is good for disseminating information and reviewing comments requiring TEMP changes.

8-31. Coordination

Coordination on documents can be done by telephone or facsimile machine.

CHARTER OF THE _____*______
TEST INTEGRATION WORKING GROUP

1. PURPOSE: This is a brief statement identifying the weapon system for which the TIWG is being established.

Example: To formally charter the * TIWG, comprised of the command representatives for the agencies listed in para 2 below.

2. MEMBERSHIP: List organizations providing members. Include organizational addresses, office symbols, electronic message addresses, and AUTOVON telephone numbers to facilitate communication between member organizations.

Example:

a. The * TIWG will be composed of one representative (principal) of each of the following:

(1) Program Manager/MATDEV

(2) Combat Developer/Functional Proponent.

(3) Developmental Tester.

(4) Developmental Independent Evaluator/Assessor.

(5) Operational Tester.

(6) Operational Independent Evaluator.

(7) Logistician.

(8) Surviveability/Lethality Analysis Directorate.

(9) Trainer.

(10) Threat Integrator.

(11) Other commands/agencies/services (when appropriate).

b. In addition to the members listed above, representatives of the agencies listed below are also included in this TIWG. These members will attend * TIWG meetings in an advisory role (such as providing comments on plans and reports and coordinating actions within their

Figure 8-1. TIWG Charter (Strawman)

respective organizations as appropriate in accordance with their assigned mission).

3. OBJECTIVE: Specific objective of each TIWG are listed.

Example: The objective of the * TIWG is to provide a forum for test planning and integration to ensure an adequate and comprehensive test program to fully validate the system.

4. PROCEDURES: The procedures section provides the broad, general guidelines under which the TIWG will operate. The method of calling meetings, representation by members, developing agenda items, and conducting meetings are included. The organization of the TIWG is shown including the other subcommittees or working groups as required. In addition, the interface of the TIWG with other activities such as design engineering, simulation, targets management, etc., is shown. Procedures are also provided for handling open agenda items, resolution of problems and preparation of minutes of each TIWG meeting. Maximum use should be made of correspondence to resolve issues in order to reduce frequency of meetings.

Example:

a. After coordination, with principal members, meetings will convene at the call of the chairperson, who will provide for the recording and distribution of minutes of meetings.

b. Not less than 2 weeks prior to each meeting, the chairperson will provide each member agency with notification of the time, place, and agenda for the proposed meeting.

c. Member agencies will be responsible for ensuring their own representation and such additional supplementary representation as may be indicated by the agenda.

d. Test integration, logistics, concepts, and training subcommittees will be established.

e. Members will be responsible for action items related to their functional areas that are specified on an Action Item List (AIL). The AIL will be revised by the agencies' representatives at each meeting. Such additions or deletions as recommended by agency representatives attending will be reviewed by the group and an updated AIL will be provided as part of the minutes.

Figure 8-1. TIWG Charter (Strawman)

f. The TIWG members will provide inputs and recommendations with regard to modification and revision to the TEMP.

g. Disagreements on matters of substance will be elevated from the TIWG to the next higher level of review for adjudication. Such matters are brought to the attention of the DUSA(OR) for resolution or guidance if agreement cannot be reached at lower levels of review.

5. DISTRIBUTION: This section includes distribution to be made of the TIWG Charter, changes thereto, minutes of meetings, plans, reports, etc.

Example:

a. This charter, minutes of all meetings, and all issues of the * TIWG AIL shall be distributed to each * TIWG principal member within 10 working days after the meeting.

b. If the minutes do not adequately reflect a member's understanding of what was accomplished at a TIWG meeting, or if a member organization's position changes, this should be brought to the attention of the chairperson for correction or added as an action item to the next TIWG Agenda within two weeks after receipt of the minutes.

c. Additional supplemental distribution of meeting minutes and AIL will be as recommended by the group.

d. Copies of T&E documentation, both government and contractor, will be provided to all TIWG members.

Signature Block
TIWG Chairman

Figure 8-1. TIWG Charter (Strawman)

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Chapter 9
Test Support Packages (TSP)

Section I
Introduction

9-1. General

Test support packages are provided, as stated above, to support conduct of Army testing for new materiel undergoing development and fielding. TSPs are primarily used during developmental and operational testing (DT and OT) prior to milestone III (production decision). They include: System Support Package (SSP), New Equipment Training Test Support Package (NET TSP), Doctrinal and Organizational Test Support Package (D&O TSP),Training Test Support Package (Training TSP), and Threat Test Support Package (Threat TSP). TSP for Automated Information Systems (AIS) will be tailored as noted. Description of the five TSP follows.

a. System Support Package (SSP). A set of support elements (equipment, manuals, expendables, maintenance tools/parts) planned for a system in the operational (deployed) environment, provided before, and tested and evaluated during developmental tests (DT) and operational tests (OT), to determine the adequacy of the planned support capability. The SSP is provided by the PEO/PM/MATDEV.

b. New Equipment Training Test Support Package (NET TSP). NET plan is prepared by the PEO/PM/MATDEV in accordance with AR 350-35 to support training development for new materiel and systems, including conduct of test and evaluation of new equipment. Based on the NET plan, the PEO/PM/MATDEV prepares, as appropriate, a NET TSP. The NET TSP is provided to the training developers and testers. It is used to train player (operators or users of new materiel) personnel for technical testing; and conduct training of instructor and key personnel who train player personnel for user testing. The TNGDEV uses the NET TSP to develop the training test support package (training TSP).

c. Doctrinal and Organization Test Support Package (D&O TSP). The D&O TSP is a set of documentation prepared or revised by the CBTDEV for each operational test supporting a milestone decision. Paragraphs or elements in the D&O TSP not needed (as determined by CBTDEV) will be annotated as "not required" in the D&O TSP. Major components are:

(1) Means of employment.

(2) Organization.

(3) Logistics concepts.

(4) Operational Mode Summary/Mission Profile (OMS/MP).

(5) Test setting.

d. Threat Test Support Package (Threat TSP). The Threat TSP is a document or set of documents that provide a description of the threat that the new system will be tested against.

e. Training Test Support Package (Training TSP). The Training TSP, consists of materials used by the trainer to train test players and by the tester in evaluating training on a new materiel system. This includes training of doctrine and tactics for the system and maintenance on the system. It focuses on the performance of specific individual and collective tasks during user testing of a new system. The Training TSP is prepared by the proponent trainer (e.g. TRADOC).

9-2. Applicability
Test support packages apply to all programs. This includes developmental, non-developmental, and changes associated with system development/acquisition acquired under the auspices of AR 70-1 for materiel systems and AR 25 series for Automated Information Systems (AIS). Test support packages are required to support developmental and operational testing (DT and OT) for both materiel and information systems.

9-3. Background
Army reorganizations of test and evaluation assets during 1988 and 1990, and subsequent mission changes affecting the materiel acquisition process for development and fielding of new, modified or product improved materiel, resulted in major revisions and rescissions of Army regulations. This caused a void in "identifying requirements" and "time schedules" associated with test support packages. Contained herein is a summarization and consolidation of documents classed as test support packages and corresponding agencies' functions and minimum requirements to support test and evaluation.

9-4. TSP preparation functions
The program executive officer (PEO), program (or project/product) manager (PM) or materiel developer (MATDEV) for new materiel is designated to prepare and provide system support package (SSP)

and new equipment training (NET) as stated in AR 70-1, AR 350-35, and AR 700-127 in support of conduct of Army testing of new materiel. The combat developer (CBTDEV) and training developer (TNGDEV) are functionally responsible for preparation of the doctrinal and organizational test support package (D&O TSP), training test support package (training TSP), and threat test support package (Threat TSP) as described in AR 73-1 and AR 381-11. AR 25-3 and AR 73-1 prescribe materiel, software, combat, and training developers as well as functional proponents TSP responsibilities for AIS.

9-5. TSP submission guidelines
Figure 9-1 summarizes the responsible organizations and delivery schedule guidelines for the five test support packages.

(INSERT FIGURE 9-1)

Section II
Preparation of System Support Package (SSP)

9-6. Introduction
The SSP is prepared and provided by the PEO/PM/MATDEV of the new equipment. The SSP is a composite of support equipment and documentation that will be evaluated during logistic demonstration and tested and certified during technical and user tests. These equipment and documentation include repair parts, tools, maintenance/training manuals, and consumable supplies. For AIS, a SSP is prepared by the PM/MATDEV for hardware and software (i.e., systems and operating), and is attached as an enclosure to the AIS. The SSP, used to validate the support system, is to be differentiated from other logistic support resources and services required for initiating the test and maintaining test continuity (AR 700-127).

9-7. Policy, responsibility, and content of SSP
PEO/PMs/MATDEVs, in coordination with CBTDEVs, training developers, technical and operational testers, logistician, and the technical and operational independent evaluators, develop the SSP component list (SSPCL). To influence test design plans, draft descriptions of the system support package should be provided 18 months prior to start of an operation test followed by approved descriptions 14 months prior to test start. The PEO/PM/MATDEV ensures that the SSPCL is furnished at least 60 days before training test start. The SSPCL will be reviewed by the Integrated Logistics Support Management Team (ILSMT)/Test Integration Working Group (TIWG) for compliance. The

contractor-delivered portion of the SSP will be directed by the PEO/PM/MATDEV. The SSP will be provided to the test/training site at least 30 days before training test start. The SSP will be thoroughly tested and evaluated during DT, OT, and any subsequent tests with critical supportability issues (system questions to be answered).

a. SSP content. The SSP is evaluated by the independent technical and operational evaluators/assessors to confirm the adequacy of planned support for the materiel systems below-depot level. The SSP will be tailored by the PM/MATDEV, in coordination with the tester and evaluator/assessor, to the supportability issues and overall level of materiel system maturity (at time of test). The SSP will normally include:

(1) Properly validated publications (operator through general support (GS) maintenance) by the materiel developer. Final draft publications will be provided.

(2) A listing of consumable supplies such as ammunition, petroleum, oils, and lubricants.

(3) The full range of spares and repair parts that are proposed for the initial support package, onboard spares, and basic issue items (BII). These spares and repair parts are provided to allow the evaluator to assess the accuracy of the predicted range and quantity of these parts and to assess the packaging, handling, storage, transportation, transportability, standardization, and interoperability of these sets of parts (Parts in excess of the spare or repair parts, BII, and onboard spares may be provided in order to ensure the test is not affected by parts shortages. These "test continuity" spares will be provided separately and are not a part of the SSP). When proposed quantities are not furnished (e.g., when unit spare or repair parts mobility is not an issue), agreement must be reached between tester and evaluator. Representative or simulated operational environment resupply times should be used in assessing the overall readiness implications for evaluation purposes.

(4) Training Devices (TDs) and instructional modules of the system to be fielded. Devices and modules should be as closely representative of the final system as possible to facilitate test and evaluation (see NET TSP).

(5) Special and all requirements for common tools (see NET TSP).

(6) Test, Measurement, and Diagnostic Equipment (TMDE). This includes hardware and software that will be required and tested with the basic system. When applicable, a representative sample of below-depot automatic test equipment (ATE) application will be tested as agreed to by the integrated logistic support management team (ILSMT) and test integration working group (TIWG). Before system deployment, all test program set (TPS) and any alternate troubleshooting procedures will be tested for adequacy of their three principal parts - software, inter-connecting device, and instruction manual. TPS will be fielded with the supported system; therefore, a deficiency in the TPS for the materiel system will be treated the same as a hardware deficiency.

(7) Proposed type of MOS and skill level.

(8) Transportation and materiel handling equipment.

(9) Calibration procedures and equipment.

(10) Mobile support facilities (for example, shop vans, supply vans, and calibration vans).

(11) Other support equipment (such as generators, trucks, trailers, and environmental equipment). All equipment necessary to form the operational configuration of the system will be included.

b. Waivers SSP requirements for Developmental Tests (DT) and Operational Tests (OT). Evaluation of materiel system supportability is mandatory (See AR 73-1) during test and evaluation for materiel in the acquisition process.DT, OT (Government-conducted, system-level portion), and subsequent tests will not be initiated when SSP shortages prevent the adequate testing of critical supportability issues. Specific requests for waiver of this requirement will be granted only for compelling reasons and only when a get-well plan has been developed that verifies adequate testing will be performed to correct support deficiencies before fielding.

(1) Requests for waiver of SSP requirements, if required, for Army acquisition category (ACAT) I and ACAT II systems, will be submitted thru OPTEC to HQDA (DALO-SM), WASH DC 20310-0547.

(2) For ACAT III and ACAT IV systems, PEO/PM/MATDEVs have authority to approve request for waiver of SSP requirements for DT. OPTEC or the designated operational test proponent has waiver authority for IOTE. Waivers granted will be reported to

HQDA (DALO-SM), WASH DC 20310-0547.

(3) All requests for SSP waivers will be coordinated with the:

(a) Logistician (AMXSY-LX; AMSAA).

(b) Participating PEO/PM/MATDEVs.

(c) CBTDEVs, trainers, testers, and independent evaluators/assessors.

(d) U.S. Army Central TMDE Activity (CTA) when TMDE items specified are not available.

(e) Other appropriate military services and agencies.

(f) ILSMT members.

(4) The SSP waiver request will include:

(a) Justification for the request.

(b) A description of the SSP shortfalls related to specific critical supportability issues.

(c) A statement of when the SSP will be furnished and the test design change required to accommodate the SSP shortfall.

(d) A get-well plan to ensure that comprehensive supportability testing will be conducted in sufficient time to correct deficiencies before fielding (for interim contractor supported (ICS) systems, SSP deficiencies will be corrected prior to transition to organic support).

c. If a waiver is required for a SSP, the request for waiver will include the information listed in paragraph 3-32b(4) of AR 700-127, which is: (1) justification; (2) description of SSP shortfalls; (3) date the SSP will be provided; and (4) deficiencies/correction get-well plan (supportability). Due to the required approval process, waiver requests must be submitted as soon as an anticipated need arises. A waiver will only be granted for compelling reasons.

(1) Processing for Acquisition Category (ACAT) I and ACAT II systems -- the materiel proponent will coordinate an SSP waiver request for both DT and OT with appropriate logistical agencies. The materiel proponent will forward the fully

coordinated SSP waiver request through HQ USAMC (AMCDE-AR) to HQDA (DALO-SM) with a copy furnished to HQ USAMC (AMCSM-SI). Upon receipt (from HQDA) of waiver approval or disapproval correspondence for DT, the materiel developer will forward a copy of the correspondence to agencies involved, TIWG members, the designated test activity (usually TECOM), and HQ USAMC (AMCDE-AR and AMCSM-SI). For OT, the correspondence should be provided to logistical agencies, OPTEC, or other designated OT proponent, and HQ USAMC (AMCDE-AR and AMCSM-SI).

(2) Processing for ACAT III and ACAT IV systems-- the materiel developer will coordinate the waiver request with appropriate ILSMT and TIWG members. This coordination should take place at a scheduled ILSMT meeting. Upon receipt, the materiel proponent will forward a copy of the approval or disapproval correspondence to affected ILSMT members. A copy of approved waivers will also be provided to HQDA (DALO-SM).

(3) Requests for waiver of type classified AIS will be as stated above. For non-type classified AIS the materiel developer will prepare the request for TIWG concurrence and distribution by the AIS functional proponent (AR 25-3).

d. It must be stressed that the SSP is tailored to the system-peculiar requirements and related to supportability testing issues. However, once the SSP for any testing phase is developed and coordinated, it should not be compromised.

9-8. Process and procedures

The SSP, for support of Army Test and Evaluation (AR 700-127, paragraph 3-32) is the prototype for the planned system support. It is a composite of the support resources that are required to support the materiel system when fielded. The SSP will be evaluated as part of the logistics demonstration (LD) during developmental testing.

a. SSP sufficiency. The PEO/PM/MATDEV, in coordination with the independent evaluators, will ensure that the SSP is sufficient to permit evaluation of logistic supportability issues in the test and evaluation master plan (TEMP). The SSP does not include those logistic support resources and services required by the tester to sustain the continuity of tests and demonstrations (for example, test site facilities, and administrative support vehicle available at the test activity).

b. Draft SSP Component List (SSPCL) delivery. The PEO/PM/MATDEV will ensure a draft SSPCL is developed in accordance with DODD 5000 (MIL-STD 1379-D, 8100 DID) series for

DT, initial operational test and evaluation, follow-on operational test and evaluation, materiel change test and any other tests with critical supportability issues. The PM/MATDEV will furnish the draft SSPCL 90 days prior to test to the ILSMT/TIWG members, who will review and identify SSP components required for each test in sufficient time for the PEO/PM/MATDEV to acquire and deliver the SSP.

c. Final SSPCL delivery. At least 60 days prior to the training test start, the PEO/PM/MATDEV will provide two copies (or as otherwise specified) of the final SSPCL to: any interested activity; TECOM (AMSTE-TA-H); Logistician (AMXST-LX); Operational Test and Evaluation Command (CSTE-OPM); TRADOC (ATCD-TRADOC action office; ATTG-YP); other combat developers, users, testers, and independent evaluators such as Army Materiel System Analysis Activity (AMXSY-LX and AMXSY-R); the Army Combined Arms Support Command (CASCOM); and U.S. Army Training Support Center (USATSC), ATTN: ATIC-DM.

d. SSP delivery. A complete SSP will be delivered to the test activity at least 30 days prior to test training initiation. When the SSP includes items available in the Army inventory, the responsible PEO/PM/MATDEV will ensure the on-site availability of such items. Upon receipt, test activities will inventory the SSP and report shortages to the independent evaluator/assessor/analyst (AMSAA, Operational Evaluation Command (OEC), or TECOM), the logistician (AMSAA, AMXSY-LX), PEO/PM/MATDEV, and MRSA (AMXMD-E) at least 25 days prior to scheduled test training initiation. If the independent evaluator/assessor determines that SSP shortages exist which prevent the adequate evaluation of any supportability-related issues, test start will be suspended until the complete SSP is available, or a waiver is obtained by the materiel proponent. The Test Incident Reporting system (Capstone volume of this pamphlet and AR 73-1) will be used for reporting the SSP inventory, where possible for technical tests and evaluations.

Section III
Preparation of New Equipment Training Test Support Package (NET TSP)

9-9. Introduction
The NET TSP is developed by the PEO/PM/MATDEV. The NET TSP provides an equipment-specific training program for the training developer or subject matter expert (instructor) to develop a training program to train troops who will be used in a specific

operational or user test. The NET TSP contains a combination of equipment-specific documents, training aids, training devices, training simulators, programs of instruction (POIs) and lesson plans.

a. NET TSP uses for tests. The training developer (TNGDEV) or training proponent will use the NET TSP to develop the Training Test Support Package (Training TSP) used by operational test participants in support of operational test execution (see para 8.7). The developmental tester will use it to conduct all technical tests during the development process.

d. NET TSP for Automated Information Systems (AIS). A NET TSP will be prepared by the PM/MATDEV for system hardware and software and provided with the AIS to the functional proponent for support of the planned testing assessments.

9-10. Planning
The PEO/PM/MATDEV will program, budget, and fund the preparation and execution of the NET TSP for each materiel system. This includes, but is not limited to, training courses, travel and per diem for Instructor and Key Personnel Training (IKPT) for instructor personnel support in Early User Test and Experimentation (EUTE), force development test and experimentation (FDTE), limited user test (LUT), follow-on operational test and evaluation (FOTE), and Initial Operational Test and Evaluation (IOTE). The development of NET TSP should be prepared in conjunction with development of the system support package since they are mutually supportive of each.

9-11. Process and procedures

a. Requirements. The NET TSP will be prepared by the materiel developer. It will include all training material required to train operators and maintainers of system peculiar tasks. The system support package must support the NET TSP and must be developed in parallel with the NET TSP. Preparation of the NET TSP includes any contractor developed training to be provided in support of operational testing.

b. Format of the NET TSP. Format and contents of the NET TSP are as follows:

(1) Title of Materiel System.

(2) Training Aids. (e.g., transparencies, 35mm slides, student handouts, and blackboard).

(3) POI/Lesson Plans. (e.g., draft or final).

(4) Technical Manuals. (May be draft, commercial or other).

(5) Points of Contact (POC). (Support Agency's POC name and telephone number required for initial coordination).

(6) Remarks. (Notes reflecting clarification of above (e. g., time schedules; support package components; additional support required to be placed in the system for test sustainment)).

(7) Maintenance. (All maintenance charts/literature should be included).

c. Schedule. Milestones for providing NET TSP will be identified by the operational tester in either the Test Evaluation Master Plan (TEMP) or the Outline Test Plan supporting the Army's Test Schedule and Review Committee (TSARC). TSARC directed tests will be identified 18 months prior to the required delivery date. The training TSP for developmental systems will be provided NLT six months prior to IOTE training start date. For nondevelopmental items, the NET TSP will be provided at least two months before IOTE training start. The NET TSP will be provided to the Training Developer as a package after completion of Instructor and Key Personnel Training (IKPT). At a minimum, IKPT must be scheduled to be completed six months prior (two months for nondevelopmental items) to the start of test player training in support of an IOTE for a Milestone Decision Review III. For EUTE and LUT, a NET TSP is required three months prior to test start. NET TSP should be provided to the technical tester 30-60 days prior to technical test start. The milestone for delivery of the NET TSP to the technical tester should be shown in TEMP. The NET TSP will be planned, developed and executed in coordination with the trainer and concurrently with the system support package. The NET TSP will be delivered to the TNGDEV or training proponent NLT six months prior to start of unit training (developmental or operational test). Deliveries of the NET TSP should be met even though the PEO/PM/MATDEV may use contractor support to develop TSP.

d. Other.

(1) The materiel developer (MATDEV) or PM/PEO pays for instructors to support tester training.

(2) TRADOC has responsibility to train test players for

IOTE.

(3) To provide the best training possible with improved test results, the contractor, prior to a MDR III, may be allowed to train the TRADOC subject matter experts (instructors) as close to the test start date as feasible for knowledge retention purpose. Training aids to include vehicles, will be provided to TRADOC instructors as early as possible prior to the training test start date to train test players. For developmental systems, the six month lead time for contractor training cited in paragraph 9-11c is applicable. However, for non-developmental item systems (NDI) with more compressed milestone schedules, contractor training for the TRADOC instructors may occur closer to start of the operational test. To ensure adequate planning, the PEO/PM/MATDEV will notify the available agencies as the acquisition strategy is developed; (e.g., TNGDEV, TESTER, and CBTDEV) and establish mutually satisfactory milestone goals.

Section IV
Preparation of Doctrinal and Organizational Test Support Package (D&O TSO)

9-12. Introduction

The D&O TSP is provided by the proponent Combat Developer (CBTDEV). The D&O TSP is used to expand, update, and add specificity to the information in the Mission Need Statement and ORD documents to support planned tests required to support a scheduled decision review milestone. The degree of completeness and the finality of the various components of the D&O TSP depend upon the phase of system development, i.e., as additional knowledge about the system and its combat capability increases, the more mature the D&O TSP becomes (MDR I vs MDR III). The D&O TSP should be updated prior to \each of the major test/analysis events during a system's development. It is made up of seven parts: references, means of employment, organization, logistics concepts, operational mode summary/mission profile, test setting, and coordination.

9-13. Policy guidance

A D&O TSP is a mandatory requirement (AR 73-1) in support of materiel or automated information system development for conduct of an LUT, initial operational test and evaluation (IOTE), and a follow-on operational test or system assessment. A D&O TSP may be required in support of CEP, FDTE, and EUTE (as determined by the combat developer or evaluator/assessor), but content will vary based on test or experiment requirements. However, as much

information as possible should be provided to ensure support of test issues as determined by the combat developer.

9-14. Functional responsibility and preparation
The combat developer is responsible for planning and development of the D&O TSP for each materiel system undergoing acquisition. The designated tester(s) should assist the combat developer or functional proponent (for AIS, AR 25-1 and 25-3; i.e., CASCOM, Ft Lee, VA) in preparing the proposed "test scenario and concept of test employment."

a. Schedule. The TSP should be provided 27 months prior to an IOTE, a LUT, and FOTE as agreed to by the TIWG or between the combat developer and tester (CEP, EUTE, FDTE, etc.) and as shown in TSARC OTP for operational testers.

b. D&O TSP approval. The combat developer or functional proponent (for AIS), is responsible for development and approval of all D&O TSP (e.g., ACAT I, II, III and IV).

9-15. D&O TSP format, process, and procedures
A suggested format for preparation of a D&O TSP is shown in Figure 9-2. Additional details describing each paragraph, as well as, procedures and process follow:

(INSERT FIGURE 9-2)

a. References. The draft or approved MNS or ORD may be referenced or attached and all other documents supporting the TSP appropriately referenced.

b. Means of Employment. (This paragraph describes how the system will be employed and supported. It includes or references documents which describe the doctrine, tactics, techniques, logistical concepts and means of employment for the tested system, including a statement on new or revised versus current doctrine. The package will include sufficient detail to permit realistic system employment for conduct of the specified type test (e.g., LUT). It is required prior to each test. It is used to guide the development of the TEP, and to govern user troop actions during test. Also, when appropriate, related documents for the new system or equipment as well as interoperable/support equipment will be shown.

c. Organization. This element defines military occupational specialty (MOS) requirements, basis of issue, unit structure, organizational concept, operating concept, and lines of command or coordination for units employing the tested system. It is

used in test planning to structure player units. When new MOSs are required, the specific duties of each MOS level must be included in the D&O TSP. AR 611-1, Military Occupational Classification Structure Development and Implementation, provides information for the development of this section of the D&O TSP.

d. Logistics Concepts. This paragraph describes the concept for planned supply, transportation, and maintenance procedures and methods for supporting the proposed or actual test system when fielded. The concept will:

(1) Describe supply concepts envisioned for class I through X supply items and outline procedures for class IX repair parts availability for the system prescribed load list (PLL) including maintenance records, PLL records, requests for class IX items, and level of maintenance.

(2) Describe what supply and maintenance including repair parts and special tools will be provided to support testing.

(3) State system transportation procedures for rail, highway, marine and air movement with emphasis on new or changed requirements.

(4) State the MOS and duty title for each required level of maintenance.

(5) Describe special tools and test equipment required to operate and maintain the system.

(6) Describe each level of maintenance responsibility during the test, e.g., military personnel, Department of Army civilian employees or contractor personnel.

(7) Describe warranty procedures to be used to ensure maintenance conformity.

(8) Include coordination annexes which lists the agencies the logistics concept was staffed with and accommodation of comments. The logistics concept should be compatible with concepts, policies, and system support stated in AR 700-127, 750-1 and TM 38-710. This section of the D&O TSP excludes the system support package provided by the materiel developer (para 3-27, AR 700-127, but each should be compatible.

e. Operational Mode Summary/Mission Profile (OMS/MP). This summary presents a description of the anticipated mix of ways the new equipment will carry out its operational role (OMS). It

includes the operational events and environment the equipment experiences from beginning to end of a specific mission laid out in a time-phased approach (MP). Additional, as required to satisfy the purpose of test, a set of operational mission profiles (attack, defense, etc.) will be shown. This section is prepared by the combat developer or AIS functional proponent in coordination with the tester, to support the operational requirement. Details that should also be included or discussed for AIS are workload, environment, mobilization, continuity of operations, data loss, and system peculiar events, for example. The OMS/MP should be provided to the tester NLT 27 months prior to start of IOTE.

f. Test Setting. Total environment (e.g, tactical, threat, terrain, weather and logistical support) under which a system is examined. The test setting defines the interactions among threat, friendly actions, and the environment (or some specific geographic location) and establishes a scenario that subjects the system under test in the context of its total environment, to include the next higher level system or organization. The test setting should be compatible with the threat support package and supporting standard TRADOC "war" scenario. Also, the size of unit, opposing force, equivalent scale of operations (e.g., company, BN, etc.) should be stated.

g. Coordination. This paragraph indicates the organizations that normally should be provided the D&O TSP for review and comment. The final D&O TSP should contain an enclosure or appendix which details the results of the coordination (See Figure 9-3 for suggested TSP coordination). The combat developer will establish appropriate coordination requirements and all coordination schedules to support timely completion of the D&O TSP prior to approval. Information contained in the D&O TSP already approved (e.g., TRADOC) shall be annotated to avoid inappropriate comments.

(INSERT FIGURE 9-3)

9-16. D&O TSP checklist
A checklist is at Figure 9-4 for use by the preparer of the D&O TSP to ensure that basic contents of the TSP are addressed.

(INSERT FIGURE 9-4)

Section V
Preparation of Threat Test Support Package (Threat TSP)

9-17. Introduction
Proponent combat and materiel developers are responsible for providing threat support, including validation, to Army testing of new materiel and systems IAW AR 381-11 (includes AIS if type classified under AR 70-1). Threat support will be provided in four ways by the proponent threat support office: (1) participation in test planning, (2) preparation of the Threat TSP, (3) providing training required by units portraying threat forces, and (4) on-site monitoring the threat portrayal prior to and during the test. This may include developmental tests, early user test and experimentation (EUTE), force development test and experimentation (FDTE), limited user test (LUT), initial operational test and evaluation (IOTE), follow-on operational test and evaluation (FOTE), and other tests conducted in an operational setting. For nonmajor and nontype classified AIS systems, the functional proponent prescribes the content and format of Threat TSP to support a test, coordinates its production, and approves it for accuracy/adequacy as well as monitoring the portrayal of threat in testing (AR 25 series).

a. Requirement. Threat TSP will be prepared for developmental and operational testing of ACAT I, ACAT II, and Operational Test and Evaluation (OT&E) systems, when an operational threat is required. Specific testing requirements for a given system will be determined by the Test Integration Working Group (TIWG). Determination of the requirement for an operationally realistic portrayal will be made by the TIWG upon the recommendation of evaluation organization based on the requirements of the TEMP, COIC/AOIC.

b. Initial Threat TSP. The initial Threat TSP (minus test specifics annexes) is developed after a milestone 0 decision, by the combat developer or functional proponent threat support organization to support future testing for a specific system or concept. This Threat TSP is derived from the system threat assessment report/system threat assessment (STAR/STA). The initial threat TSP is more detailed than the STAR/STA and provides the threat scenarios to support a specific test and assesses the impacts of threat-related test limitations. To support technical test requirements, the PEO/PM/MATDEV proponent (threat support organization/office) is responsible to expand and tailor the initial Threat TSP for each test in which threat force operations are to be portrayed realistically. For operational tests, the combat developer or functional proponent threat support activity will expand and tailor the initial Threat TSP for each operational test requiring a realistic threat portrayal.

c. Final Threat TSP. The final Threat TSP includes an update of the initial Threat TSP plus a section of several appendices that are developed on an iterative basis to support specific tests approved by the TEMP. The appendices become part of the Threat TSP and must be completed before final TSP approval can be granted.

d. DA Threat Integration Staff Officer (TISO) involvement. As a member of the TIWG for ACAT I, II, and OSD OT&E oversight systems, the TISO advises threat representatives from the combat and materiel developers of tests scheduled and the anticipated threat support requirements at the initial threat coordinating group (TCG) meeting. TRADOC Threat Managers and AMC Foreign Intelligence Officers serve as the principal threat integrators for operational and developmental tests, respectively.

e. ACAT III and IV systems applicability. Threat TSPs for ACAT III and IV systems will be prepared when a portrayal of a threat is required and determined by the TIWG.

f. Validity. When approved by the appropriate agencies (e.g., TRADOC for user tests), the Threat TSP describes the threat to be used for planning and developing the test and portrayed during test execution. An approved Threat TSP, however, does not ensure that test threat portrayal is valid. Two separate approval/validation actions are required--one for the Threat TSP and one for the threat portrayal during the test. The approved threat is included in the approved Test and Evaluation plan prior to execution of test.

g. AIS content. AIS Threat TSP contents and format will be specified by the combat developer or functional proponent for acquiring information systems, see para 9-17a.

9-18. Threat TSP structure and format
The Threat TSP will contain the four major sections listed below. Preparation of the initial Threat TSP (Sections I-III) focuses on Section III (technical, tactical, and organizational threat) since much of the information to complete the remaining sections often is not available initially. Section IV focuses on the test scenario and is finalized in coordination with the tester. Figure 9-5 provides a recommended Threat TSP preliminary package format for use as a guide during Threat TSP preparation. A discussion of this format follows:

(INSERT FIGURE 9-5)

a. Title page. Self explanatory.

b. Tables of contents and illustrations. Self explanatory.

c. Section I Background Information. Self explanatory.

d. Section II Critical Operational Issues and Criteria/ Additional Operational Issues and Criteria (COIC/AOIC). COIC are key issues, with associated scope, criteria, and rationale which must be answered for the Full Production decision (normally Milestone III decision review). They provide broad insight into threat support requirements. AOIC are developed by the evaluator to complement or support evaluation of the COIC as well as provide for comprehensive evaluation of the total system. Approved COIC/AOIC sometimes are not available when beginning the development of the draft Threat TSP. Draft COIC can be obtained from the combat developer, or the evaluator, and used to initiate preparation of the Threat TSP. The Threat TSP, however, cannot be completed until the COIC/AOIC are approved, nor forwarded for approval/validation unless the approved COIC/AOIC are included in Section II.

e. Section III Threat. This section is required approximately 18 months prior to the actual test (T-540). When initially developed, it will be somewhat generic in nature but adequate for test planning. As test requirements are better defined, this section will be revised to describe the specific threat required for the test. Should an extensive amount of material be required, systems and tactical considerations are to be summarized with references to more detailed and approved intelligence documents. This section will include:

(1) Specific systems and units/organizations that are a threat to, or a target of, the system, organization or concept being tested; include technical descriptions of threat systems and TO&E for units.

(2) Threat tactics, doctrine, techniques, procedures and flight profiles (as appropriate).

(3) Threat countermeasures. Primary sources of information include the STAR and other DIA-approved intelligence documents.

f. Section IV Test Specific Appendices. The following appendices are essential elements of the Threat TSP and will be added as completed. All required appendices must be included with the Threat TSP when it is forwarded for final approval. Resources identified to support the test must also be shown in the outline test plan (OTP).

(1) Appendix A Test Concept (Draft of TEP Chapter 3-1). The test concept is developed by the tester from Chapters 1 and 2 of the TEP prepared by the evaluator. It will describe in detail, the test scope and criteria. The test concept will be used to define the required threat for a specific test.

(2) Appendix B Scenario. The test scenario describes how the test unit and OPFOR operations should be conducted. Selection of the scenario is the responsibility of the combat developer in coordination with the test organization. The test organization, in coordination with the threat support office, is responsible for integrating the approved threat into the scenario. Normally, test scenarios are based on TRADOC-approved low-resolution or high-resolution scenarios or other recent and related combat developments actions. All aspects of the scenario must be reviewed from the threat perspective to ensure adequate portrayal in support of the stated operational issues and criteria (OIC). Areas to consider include: scheme of maneuver, TO&E organization, types of equipment, tactics and supporting fires or forces.

(3) Appendix C Description of trials/test runs/ vignettes. This appendix describes how the test operations will be conducted. The Threat TSP must include a description of the threat forces and operations that will be used to portray the scenario during the test. Templates showing threat force locations, routes of movement, and listing of threat force organizations and equipment to be used in the test are required. Inclusion of this information allows reviewing agencies to determine whether or not the threat will be portrayed accurately to support the OIC.

(4) Appendix D Firer/target matrix. The test organization and the threat support office representative will participate in the development of instrumentation and possibly modeling data requests (Ph and Pk numbers) developed and submitted by the proponent school or, in some cases, the test agency. The data requests will normally be in the form of a firer/target matrix that is submitted for approval. When required, the firer/target matrix is prepared by the proponent threat office and the test organization.

(5) Appendix E Targets, threat simulators, and/or surrogate equipment. Most field testing requires the use of U.S. Army, NATO or contractor equipment to be used in lieu of actual threat systems. Assessments are to be limited to features that are applicable to the specific test. For example, if the test threat systems are to be immobile during a test, then it is not

appropriate to point out that the surrogate systems are not as fast as the actual threat system it is attempting to portray. Validation and accreditation reports contain information on the fidelity and suitability of targets and surrogates, and threat simulators used for testing. These are listed in the outline test plan and contain technical information needed to assess the impact of shortcomings related to the threat equipment as potential test limitations. A list of all threat-related equipment required for the test, available from the Outline Test Plan written by the tester, should be included in the Threat TSP. The evaluator/tester will identify the OPFOR equipment required for test.

(6) Appendix F Limitations. The test evaluator and test organization will make known overall threat-related test limitations, i.e., tactics, equipment or other aspects which might affect the test, to include appropriate rationale. The preparer is required to assess and describe the effects of these stated limitations, plus any limitations they perceive, on the ability of the test agency to portray a valid threat.

(7) Appendix G Threat force training plan. A threat force training plan is mandatory for force-on-force tests or tests involving any threat replication requiring threat player personnel. The proponent will develop a threat force training plan to train the designated player units in the threat tactics and situations to be portrayed in the test. The threat force training plan will include a POI. The POI should be based on what the test threat force needs to know for the specific test.

9-19. Process and procedures

a. Basis. The Threat TSP is derived from the System Threat Assessment Report/System Threat Assessments (STAR/STA), which is used to define the tactical context for the test. The Threat TSP helps define the operational test environment described in Chapter 3 of the test evaluation plan (TEP) and provides the threat scenarios for each test. The Threat TSP must be sufficiently detailed to enable the tester to accurately portray the threat to the test system level in an operationally realistic test environment at a specified post-IOC date (e.g., one year after fielding of the new equipment). Determination of the post-IOC date and scenario selection will be made by the TIWG based on recommendations of the systems proponent and evaluation organization.

b. Schedule. The Threat TSP will be prepared/updated to meet the testing milestones as set by the appropriate TIWG. Normally,

the draft Threat TSP must be submitted 18 months before the test (T-540) for approval/validation by the appropriate authorities (See Table 2-1, AR 381-11) which must be accomplished 14 months before the test (T-420).

c. Preparation. For materiel systems or applicable AIS (under AR 70-1), the combat developer or functional proponent threat support organization/activity will prepare the initial Threat TSP, after a milestone 0 decision review, and all subsequent iterations that support operational testing (EUTE, LUT, IOT&E, and FOTE) requiring threat portrayal. The PM/materiel developer proponent threat support office will assist in the preparation of initial Threat TSP and prepare all subsequent iterations that support developmental testing. Timely completion of the Threat TSP depends on early and continuing coordination and the exchange of test planning data between the test agency and the threat support activity.

d. Approval. Guidelines for Threat TSP approval follow:

(1) DA ODCSINT will approve all Threat TSPs developed for testing of ACAT I, II and OSD OT&E oversight systems. DA ODCSINT will forward a copy of the threat TSP for ACAT ID and IC systems to DIA for review and comment (through MDR I).

(2) TRADOC, or the appropriate MACOM responsible for non-TRADOC managed systems, will approve all Threat TSPs for all system categories and validate all Threat TSP developed for operational testing of ACAT III and IV systems, exempted from OSD OT&E oversight.

(3) AMC, or the appropriate materiel developer, will approve Threat TSPs developed for developmental testing of ACAT III and IV systems exempted from OSD T&E oversight.

(4) Approval of the Threat TSP will take place only after all sections/appendices are completed. As sections/appendices are developed, they should be coordinated with the MACOM threat approval authority and if an ACAT I, II or OSD T&E oversight systems, DA ODCSINT for initial review. This allows use of these sections/appendices in the test planning process prior to final approval of the Threat TSP. The Test and Evaluation Plan (TEP) cannot be finalized prior to receipt of an approved Threat TSP.

(5) For each operational test for which a Threat TSP has been prepared, validation of both the Threat TSP, threat force training plan (where applicable), and the approved test threat portrayal is required. This validation provided by the portrayal

validation authority, is documented in the Operational Test Readiness Statement prepared by the combat developer for Operational Test Readiness Reviews. Pretest threat portrayal validations will not be granted without completions of accreditation of the threat equipment. Threat portrayal is monitored by the appropriate threat support organization and threat validation authority.

(6) For AIS, the appropriate functional proponent will approve and validate the Threat TSP and ensure the accuracy/ adequacy of the portrayal of threat in testing.

e. Classification. Threat TSP classification will be limited to SECRET. Higher level supplements may be added as needed.

Section VI
Preparation of Training Test Support Package (Training TSP)

9-20. Introduction

The Training TSP is provided to the test agency by the training developers (proponent) of the new system. A Training TSP is assembled by the proponent training developer for each affected operator and maintainer MOS. Where there are system cross proponent responsibilities, the proponent for the requirement will be responsible for assembly of training materials for supporting MOS. The lead proponent will consolidate the package and assure it does not contain conflicting requirements. The Training TSP contains information used by the trainer to train test players and for the tester's use in evaluating training on a new materiel system. It focuses on the performance of specific individual and collective tasks during user testing of a system. The Training TSP package should be updated prior to each of the major user test/analysis events (early user test and experimentation, LUT, follow-on operational test and evaluation, and initial test and evaluation) during a system's development or as required by the TEMP or OTP. Training TSP for AIS will be tailored to the skills and abilities of the target audience scheduled to use the system. If there are no specified MOS to use the AIS, it should be addressed and the users described.

a. Training TSP contents. A Training TSP consists of the following: The System Training Plan (STRAP); the Training Certification Plan: the training schedule, the program of instruction (POI) for each military occupational specialties/special skill identifiers (MOS/SSI) involved in the testing; training data requirements; the Army Training Evaluation

Program (ARTEP)/Mission Training Plan (MTP) and ARTEP/MTP changes; a list of training aids, training devices, and embedded training components; a target audience description; soldier training publications or changes, crew drills, lesson plans; ammunition, targets, and ranges required for training; and a critical task list.

b. Training TSP input. Logistics oriented schools and non-proponent schools which manage MOSs involved with the new system are responsible for developing Training TSP input (e.g., POI; Lesson plans; STRAP changes; training data requirements; ARTEP/MTP changes; target audience descriptions; crew drills; ammunition; targets and ranges required for training; and critical task list) to the lead proponent. This is in addition to the NET TSP provided by the materiel developer. All Training TSP input must be provided in sufficient time from responsible agencies to the training developer to allow the TSP to be submitted on time to the tester (e.g., 60 days prior to start of test player training).

c. AIS Training TSP. When required, the AIS Training TSP will be prepared as specified by the training proponent for the information system under development.

d. Support Documentation. The Training TSP may provide or make reference to supporting documentation to the TSP. Attachment(s) should depend on availability of referenced documents.

9-21. Policy, process, and procedures
The proponent training developer (or when TRADOC is the proponent) is responsible for developing, coordinating, and providing the Training TSP to the test agency. Training TSP items identified in paragraph 9-21d below will be submitted for approval to HQ TRADOC or Major Army Commands (MACOMs) assigned responsible for non-TRADOC systems.

a. Initial Submission. The initial Training TSP consists of the approved STRAP/training data requirements, and the Certification Plan. It provides the test agency with the training concept for the system, the training issues upon which the trainer requires data, and the method for training test players are trained. The initial submission is due to the test agency from Test (T) start minus (-) T-18 months, or as specified in the OTP.

b. Final Submission. The Training TSP is a full package. It is prepared following instructor and key personnel training

(IKPT) and receipt of the New Equipment Training Test Support Package which should occur six months prior to start training date for developmental systems and not later than two months prior to start training date for NDI systems. The final Training TSP is submitted to HQ TRADOC 60 days (TRADOC systems) prior to the commencement of test player training.

c. Functions.

(1) HQ TRADOC, ATTG-Y (TRADOC systems only; other TNGDEV should confirm procedures with responsible MACOM).

(a) Provides guidance on preparation, coordination, approval and distribution of the Training TSP.

(b) Serves as approving authority for all STRAPs and Training TSPs.

(c) Serves as the TRADOC policy element for the STRAP and the Training TSP.

(2) USAOPTEC.

(a) Reviews draft Training TSP and provides comments to proponents.

(b) Ensures Training TSP is included as part of the Test and Evaluation Plan (TEP) development process.

(c) OPTEC will host the operational readiness review (OTRR). OPTEC will ensure all training is completed prior to start of test (two week minimum).

(3) Training Proponent (e.g. TRADOC schools for TRADOC Systems).

(a) Prepares initial and final Training TSPs in coordination with supporting schools.

(b) Forwards approved copies of initial and final Training TSPs to the tester.

d. Training TSP content.

(1) Initial submission. The Initial Submission Training TSP contains:

(a) System Training Plan (STRAP). The STRAP should be

approved prior to including it in the Training TSP. Approval of the Training TSP should not be construed as approval of the STRAP. See TRADOC Reg 351-9 for a detailed description of the contents of each paragraph in the STRAP.

(b) Test training certification plan. The plan outlines and describes the method and procedures for evaluating and certifying individual and collective pre-test training. Specifically, it describes the who, where, and how training is certified.

(c) Training data requirements. Data requirements and milestones should be identified.

(2) Final submission. The submission of the final Training TSP contains:

(a) Training schedule.

(b) POI for each MOS/SSI affected.

(c) ARTEP/MTP or changes to ARTEP/MTP.

(d) List of training devices, embedded training components, and simulators.

(e) Target audience description.

(f) Soldier training publications or changes.

(g) Crew drills.

(h) Lesson plans.

(i) Ammunition, targets, and ranges required for training. (Submit to TRADOC for approval.)

(j) Critical MOS task list.

9-22. Checklist

Figure 9-6 provides a checklist for use during preparation of the Training TSP.

(INSERT FIGURE 9-6)

SOURCE	PREPARED BY	PROVIDED TO	TIMING	CHAPTER 9 REFERENCE
System Support Package AR 70-127, Para 3-32	PEO/PM/MATDEV	Evaluator/Assessor, ILSMT/TIWG, etc.	Tng-60 (SSPCL)	9-8c
		Tester	Tng-30	9-8d
New Equipment Training AR 350-35, Para 2-3d	PEO/PM/MATDEV	Trainer or TNGDEV	T-30/60 (DT) T-90 (EUTE/LUT)	9-11c
			Tng-180 (IOTE)	
Doctrinal and Organizational AR 73-1, Para 2-15a(3)	CBTDEV	Tester	T-810 (LUT/IOTE/FOTE)	9-14a
			CBTDEV/TIWG Coordinated (CEP/EUTE/FOT&E)	
Threat AR 381-11, Ch 2, Para 2-10 and Table 2-1	Proponent Threat Manager (OT)	Approval Authority (DRAFT)	T-540	9-19b
AR 73-1, Para 2-13a(5) & 2-15c(2)	Proponent and Foreign Intelligence Officer (DT)	Tester (FINAL)	T-420	
Training AR 350-35, Para 4-3	TNGDEV	Tester	Tng-540 (DRAFT)	9-21a
AR 73-1, Para 2-15b(2)			Tng-60 (FINAL)	9-21b

FIGURE 9-1 SUMMARY OF REQUIREMENTS FOR TEST SUPPORT PACKAGES

1. Title Page (type of test, system, date, etc.).

2. References.

3. Means of Employment.

   a. Field Manuals (FMs).
   b. Field Circulars (FCs).
   c. Training Circulars (TCS).
   d. Soldiers Manuals (SMs).
   e. Operators Manuals.
   f. Tactical Unit Standing Operating Procedures (TAC SOP).
   g. Communications-Electronic Operating Instructions (CEOI).
   h. Equipment Storage Plans (Load lists).

4. Organization.

   a. Basis of Issue Plan (BOIP).
   b. Qualitative and Quantitative Personnel Requirements Information (QQPRI).
   c. Organization Plan.
      (1) Introduction.
      (2) System Description.
      (3) Organizational Concept (Unit).
      (4) Operating Procedures.

5. Logistics Concept.

   a. Purpose.
   b. Source.
   c. Description.
   d. Supply.
   e. Transportation.
   f. Maintenance.
   g. MOS by level of maintenance.
   h. Special tools and test equipment.
   i. Coordination Annex.

6. Mission Profiles.

7. Test Setting.

8. Coordination.

9. Approval authority.

NOTE: Content will vary based on purpose of TSP and/or MDR decision and as deemed necessary by the CBTDEV and Evaluator (tester).

FIGURE 9-2 RECOMMENDED FORMAT FOR A DOCTRINAL AND ORGANIZATIONAL TSP

ORGANIZATION	TYPE TEST/EXPERIMENT *EUT&E/OT&E	FDT&E/FDEV/CEP TEST
USAOPTEC/TEXCOM	X	
CBTDEV (PROPONENT)	X	X
CO-PROPONENT (IF USED)	X	X
MATERIEL DEVELOPER	info	
TECHNICAL TEST ACTIVITY	info	
TRADOC SYSTEM MANAGER	X	
TECHNICAL EVALUATOR	info	
TRAINER (HQ TRADOC or responsible MACOM for non-TRADOC systems)	X	X

*NOTE: OT&E includes LUT, IOT and FOT.

FIGURE 9-3 TYPICAL COORDINATION FOR
A DOCTRINAL & ORGANIZATIONAL TSP

CHECKLIST FOR DOCTRINAL AND ORGANIZATIONAL
TEST SUPPORT PACKAGE (D&O TSP)

1. Following is a list of items to consider during preparation and review of D&O TSP:

a. <u>References and title page</u>. Administrative information and ORD/TSARC references (current and available).

b. <u>Means of Employment</u>.

(1) Does the D&O TSP provide a complete, current listing of the doctrinal materiel that will be required for the new system at the unit level, e.g., FMs, FCs, TCs, SMs, operators manuals (may be included in the SSP), TAC SOPs, CEOIs, and load plans?

(2) Does the D&O TSP provide a listing of the doctrinal material used at staff levels above the operating unit that must be changed or augmented to support fielding of the system? Interoperability?

(3) Are drafts of, or changes to the listed or referenced documents included in the D&O TSP?

(4) Is the draft documentation such that it addresses system employment and permits development of the TEP, DTP and other T&E planning documents, e.g., TEMP, COIC, etc.?

(5) Are dates for delivery of the Tactical SOP, communication/electronic and loading instructions and plans established?

(6) Does the scope state the tactical scenario?

c. <u>Organization</u>.

(1) Are draft or final TOEs for units employing the system up to battalion level or equivalent included? BOIP, QQPRI referenced?

(2) Does the D&O TSP include a detailed description of the operational concept for employing the system in combat to include lines of communication and coordination through division level?

(3) Does the D&O TSP describe each of the system employment options, e.g., direct support, general support, attachment, etc.?

FIGURE 9-4 D&O TSP CHECKLIST

(4) Are the operating procedures for each option described in detail?

(5) Are the lines of C3 for the system clearly delineated?

(6) Are the degraded mode(s) of operation described in detail?

(7) Are the various communications options (wire, radio (voice, digital data, secure, etc.), facsimile, etc.) described?

(8) Are related operational and organizational concepts included in the D&O TSP? This applies when the system under development/test is used in conjunction with or to employ other systems. An example of a system requiring special treatment is the Fire Support Team Vehicle (FISTV) which in addition to its usual field artillery missions may be required to employ Hellfire missiles, U.S. Air Force laser guided and conventional weapons and other systems. The D&O TSP should include the employment concepts for each such related system.

(9) MOS's discussed?

d. Logistics Concepts.

(1) Are the logistical concepts for the system through the direct support level incorporated into draft FMs and support documents?

(2) Are they shown in FM (draft/final)?

(3) Are the logistical concepts detailed enough so that testing can be accomplished through the direct support level?

(4) Are all major logistical areas included (e.g., supply, maintenance, transportation).

(5) Does the logistics concept include procedures for use of operational readiness floats (ORF)?

(6) Type of support stated (troop, contract)?

(7) Are there environmental impacts(e.g., manufacturing, supply actions)?

e. Operational Mode Summary/Mission Profile.

(1) Has the OMS/MP been expanded or updated since the last user test and/or publication of the ORD?

FIGURE 9-4 D&O TSP CHECKLIST (cont'd)

(2) Does the OMS/MP describe the events and frequency of occurrence and duration events in attack, defense, exploitation and retrograde operations? State alternate missions?

(3) Does the OMS/MP state the frequency and duration of responses to threat use of countermeasure such electronic warfare and/or radio electronic combat, obscurants and NBC weapons?

f. Test Setting.

(1) Does the setting detail friendly and threat force actions down to the unit level?

(2) Are the probable areas of employment for the proposed system stated?

(3) Does the setting state the primary areas of employment for the proposed system?

(4) Is the approved scenario on which the test setting is based referenced? (Include sequence number and date of the scenario).

(5) Does the setting state or relate to standard TRADOC theater-level scenario and/or threat support package?

(6) Does the test setting identify the type force structure for the proposed system?

2. After finalizing contents, ensure that adequate coordination is accomplished. A suggested coordination list is shown in Figure 8-2 for the D&O TSP.

FIGURE 9-4 D&O TSP CHECKLIST (cont'd)

1. Title page. (Preparing agency, information cutoff date, U.S. system project office, and the MACOM or DA validation date).

2. Tables of contents and illustrations.

3. Section I Background Information.

   a. Description of system, organization or concept to be tested.
   b. Type of test.
   c. Evaluating agency.
   d. Test organization.
   e. TRADOC proponent school.
   f. Test dates.
   g. Test location.
   h. Simulated location (e.g., central Europe).
   i. IOC of system being tested.
   j. Threat year.

4. Section II Critical Operational Issues and Criteria/Additional Operational Issues and Criteria (COIC/AOIC).

5. Section III Threat.

   a. Specific threat systems and units/organizations.
   b. Threat tactics, doctrine, techniques, procedures and flight profiles (as appropriate).
   c. Threat countermeasures.

6. Section IV Test Specific Appendices.

   a. Appendix A Test concept (Draft of TEP Chapter 3-1).
   b. Appendix B Scenario.
   c. Appendix C Description of trials/test runs/vignettes.
   d. Appendix D Firer/target matrix.
   e. Appendix E Targets, threat simulators, and surrogates.
   f. Appendix F Limitations.
   g. Appendix G Threat force training plan.

FIGURE 9-5 RECOMMENDED FORMAT FOR A THREAT TSP

CHECKLIST FOR TRAINING TEST SUPPORT PACKAGE
(Training TSP)

1. Initial Submission of the Training TSP.

a. Were development procedures outlined in TRADOC Reg 351-9 followed for the STRAP?

b. Did the STRAP address:

(1) The system description?

(2) Assumptions?

(3) The training concept?

(4) The training device strategy?

(5) Significant training issues at risk?

c. Did the Test Training Certification Plan describe the method and procedures for evaluating and certifying individual and collective pre-test training? Specifically, did it describe the who, where, and how training is to be accomplished and the method of certification?

d. Were the STRAP and Test Training Certification Plan submitted within the time frame prescribed?

e. Did the Training Data Requirements provide training issues outlining the need for data on individual/collective performance, technical manuals, etc.?

2. Final Submission.

a. Is final Training TSP submitted to HQ TRADOC at least 60 days prior to the test date?

b. Does the final Training TSP include:

(1) The training schedule?

(2) The POI for each MOS/SSI affected?

(3) FMs/FM Changes References?

(4) The ARTEP/MTP or changes to the ARTEP/MTP?

FIGURE 9-6 TRAINING TSP CHECKLIST

(5) A list of training devices, embedded training components, and simulators?

(6) A target audience description?

(7) Soldier training publications or changes?

(8) Crew drills?

(9) Lessons Plans?

(10) A list of ammunition, targets, and ranges required for training?

(11) A critical task list?

c. Does the Training TSP include information from each MOS proponent school affected?

d. Does the Training TSP lay out who is responsible for training those tasks taught in the institution and unit?

e. Does the TRAINING TSP contain all of the material needed to train test players on operator and maintainer tasks?

f. Is field training necessary? Does it train operator crews to operate the system to its desired capability? Is night training appropriate?

g. Are tactics, techniques, and procedures (DTT) taught to test players? Does it agree with the employment described in doctrinal manuals?

h. Is there sufficient time built into the training schedule for the unit to become proficient with the system?

i. Will training devices be available to support test training?

j. How much ammunition is required to support training? Is it supportable?

k. Is the test player a "typical soldier" in his career field?

FIGURE 9-6 TRAINING TSP CHECKLIST CONTINUED

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Chapter 10
Test and Evaluation in Support of Integrated Logistics Support (ILS)

Section I
General

10-1. Introduction
This chapter explains for testers and evaluators how to plan, conduct, and report testing and CE of system logistics supportability (figure 10-1).

(INSERT FIGURE 10-1)

a. This chapter covers the development of logistics support test requirements and the conduct of supportability assessments to ensure that readiness and supportability objectives are identified and achieved. The ILS Manager must ensure the ILS T&E objectives are considered and that adequate resources are available for ILS T&E.

b. The methodologies described in this chapter address T&E of ILS elements that should be available in the system support package from which the test support package is derived as well as logistics support concepts, doctrine, and organization (see glossary for definition) as described in the MNS, ORD, RRR, ILSP and the D&OTSP.

10-2. ILS Defined
ILS is defined as a disciplined, unified, and iterative approach to the management and technical activities necessary to:

a. Influence operational and materiel requirements and design specifications.

b. Define the support requirements best related to a system design and to each other.

c. Develop and acquire the required support.

d. Provide the required operational phase support at lowest cost.

e. Seek readiness and life cycle cost improvements in the materiel system and support systems during the operational life-cycle

f. Repeatedly examine support requirements throughout the life of the system.

10-3. ILS Elements
ILS consists of 12 specific components, or elements.

a. Maintenance Planning.

b. Manpower and Personnel.

c. Supply Support.

d. Support Equipment and Test, Measurement, and Diagnostic Equipment (TMDE).

e. Technical Data.

f. Training and Training Devices.

g. Computer Resources Support.

h. Facilities.

i. Packaging, Handling, and Storage.

j. Design Influence.

k. Transportation and Transportability.

l. Standardization and Interoperability.

10-4. Philosophy of T&E for Logistics Supportability

a. T&E of the logistics supportability will be accomplished throughout a system's life cycle per AR 700-127. A level-of-repair analysis should be accomplished early in the life cycle to guide test planning for supportability issues.

b. Early test data will be used to determine the achievement of support-related design characteristics, including BIT/BITE embedded training. Early test data will also be used to determine the ability to meet system readiness objectives (when mature), the most effective logistics support for the end-item, and the acceptability of the logistics support analysis, and to assist in developing the logistics support analysis record (LSAR).

c. Subsequent testing and field experience will be used to

improve the matured logistics support program; to update the LSAR; to determine the effectiveness, adequacy, performance, and RAM of system-peculiar support equipment, test program sets, support software, and TMDE; and to update the LSAR and system repair parts provisioning documentation.

d. Logistics supportability tests include logistic demonstration and formal evaluation of the system support package during testing.

e. Supportability T&E will be conducted per AR 700-127 and DA Pam 700-50. Logistics supportability will be a primary factor in all program and budget decisions associated with T&E.

f. Testers and evaluators will ensure that a full range of supportability characteristics and issues are developed and that test designs specifically address these characteristics and issues.

g. In all materiel acquisition programs, the ILS effort begins in the concept exploration and definition phase prior to program initiation, continues throughout the entire acquisition cycle, and extends past the deployment phase. Logistics testing must therefore extend over the entire acquisition cycle of the system and be carefully planned and executed to ensure the readiness and supportability of the system.

Section II
ILS T&E Documentation

10-5. Documentation Objectives

The main objective of ILS test and evaluation is to verify that the logistic support being developed for the materiel system is capable of meeting the required objectives for both peacetime and wartime employment. ILS T&E consists of both DT&E and OT&E, and also includes post-deployment supportability assessments.

10-6. Integrated Logistic Support Plan (ILSP)

a. The ILS Manager (provided by the PM/MATDEV) for an acquisition system is responsible for developing the ILSP, which is the primary document for planning and implementing the support of the fielded system. It is initially prepared during the Concept Exploration phase, then is progressively developed in more detail as the system moves through the acquisition phases.

b. Included in the ILSP is identification of the specific ILS test issues related to the individual ILS elements and the overall system support and readiness objectives.

c. The ILS Manager is assisted throughout the different phases of the development process by the ILS Management Team (ILSMT), which is formed early in the acquisition cycle. The ILSMT is a coordination/advisory group comprised of many of the TIWG members, to, include the IDE, IOE, the testers (DT & OT), logistician, and trainer personnel from the PM/MATDEV and CBTDEV offices.

10-7. Supportability Assessment Plan

a. Based upon the objectives as outlined in the ILSP, the ILS Manager, in conjunction with the ILSMT (and in coordination with the TIWG), develops the Supportability Assessment Plan. The plan identifies the testing approach and evaluation criteria that will be used to assess the supportability-related design requirements (e.g., reliability and maintainability) and adequacy of the planned logistic support resources for the system. Development of the plan begins upon approval of the ILSP, and is then updated and refined as the program progresses through the acquisition cycle.

b. The ILS manager applies the techniques of Logistic Support Analysis (LSA), as described in Mil-STD-1388-1A, to formulate the ILS test and evaluation strategy, establish the T&E program objectives and criteria and identify required test resources. He must ensure that the ILS T&E strategy is based upon quantified supportability requirements and that the necessary quantities and types of data will be collected to validate the various T&E objectives, both during system development and after deployment of the system.

c. The T&E objectives and criteria must provide a basis upon which to ensure that critical supportability issues and requirements are resolved or achieved within acceptable confidence levels.

10-8. ILS and the TEMP

All planned/required ILS T&E should be included in the TEMP. It is of critical importance that all test resources required for ILS testing be identified in the TEMP, in order to ensure that appropriate resources are budgeted and allocated for testing.

Section III
Planning for ILS T&E

10-9. Planning Guidelines
Proper planning is essential to the conduct of an effective T&E program. The following guidelines will assist in planning for ILS T&E:

a. Develop a logistics test and evaluation strategy for the overall program. This should be performed in the Concept Exploration Phase. Coordination during staffing of the TEMP should include the logistics evaluator to determine when a Logistics Demonstration (LD) (if needed) will be performed.

b. It is important to understand that the TEMP is a master test planning document and not a logistics test plan. The TEMP is limited to 30 pages. A determination should be made as to what tests can provide useful ILS data.

c. Integrate ILS testing requirements (where feasible) into the existing DT&E/OT&E plans. This is accomplished through the TIWG.

d. Identify all required resources, to include test articles and logistic support items for DT, OT, and dedicated ILS testing.

e. In general, OT is the primary source of ILS data. User tests are conducted in a realistic environment with personnel representative of those who will eventually operate and maintain the fielded system. Some LSA data can be gained from developmental testing such as early wear data, some maintainability difficulties, etc.

f. Ensure full utilization of all data collected during the conduct of the T&E program to reduce dedicated ILS testing, and to assure maximum efficiency.

10-10. Criteria for Evaluation Planning
Detailed evaluation criteria for each of the ILS elements listed above are presented in DA PAM 700-50,"Integrated Logistic Support: Developmental Supportability Test and Evaluation Guide."

Section IV
Conducting ILS T&E

10-11. Objectives for ILS T&E

a. To measure the supportability of a developing system throughout the acquisition process.

b. To identify supportability deficiencies and potential corrections/improvements as test data becomes available.

c. To assess the operational effectiveness of the planned support system.

d. To evaluate the system's operational suitability relative to it's ability to achieve planned readiness objectives.

10-12. Makeup of ILS T&E

ILS T&E consists of a series of ILS demonstrations and assessments which are usually conducted as part of system performance tests. Special end-item equipment tests are rarely conducted solely for ILS evaluation.

10-13. ILS T&E Tasks

Specific ILS T&E tasks (as prescribed in MIL-STD-1388-1A) include:

a. Analysis of test results to verify achievement of specified supportability requirements.

b. Determination of improvements in supportability and supportability-related design parameters needed for the system to meet established goals and thresholds.

c. Identification of areas where established goals and thresholds have not been demonstrated within acceptable confidence levels.

d. Development of corrections for identified supportability problems such as modifications to hardware, software, support plans, logistic support resources, or operational tactics.

e. Projection of changes in costs, readiness and logistic support resources due to implementation of corrections.

f. Analysis of supportability data from the deployed system to verify achievement of the established goals and thresholds and, where operational results deviate from projections, determination of the causes and corrective actions.

10-14. System Support Package (SSP)

a. T&E of the support for a materiel system requires a SSP consisting of spares, support equipment, technical documents and publications, representative personnel, any peculiar support requirements, and the test article itself; in short, all of the items that would eventually be required when the system is operational.

b. This complete support package must be at the test site before the test is scheduled to begin. Delays in the availability of certain support items could prevent the test from proceeding on schedule (which can be costly due to on-site support personnel on hold or tightly scheduled system ranges and expensive test resources not being properly utilized) or could result in the test proceeding without conducting the complete evaluation of the support system.

c. The ILS test planner must ensure that the required personnel are trained and available, that test facility scheduling has been accomplished, and that the test support package is on site on time. For more information on the SSP, see Chapter 9.

10-15. ILS Test Data

a. In order to facilitate data sharing and continuous evaluation, the ILS Manager should coordinate with the appropriate TIWG members to ensure that the methods used for collection, storage, and extraction of ILS T&E data are compatible with those used in testing the materiel system.

b. As with any testing, the ILS test planning must ensure that all required data are identified; that they are sufficient to evaluate system readiness and supportability; and that plans are made for appropriate data classification, storage, retrieval, and reduction necessary for analysis.

10-16. ILS Test Emphasis
The emphasis of the ILS evaluation changes as the program moves through the acquisition phases. During early phases of a program, the evaluation results are used primarily to verify analysis and develop future projections. As the program moves into Engineering and Manufacturing Development and hardware becomes available, the evaluation addresses design, particularly the reliability and maintainability aspects, training programs, support equipment adequacy, personnel skills and availability, and technical publications.

10-17. ILS Shortcomings

The ILS Manager must assure that logistical shortcomings are identified during the T&E process, and that appropriate action is taken made to correct deficiencies. Coordination with the TIWG members is essential to the conduct of meaningful, efficient ILS T&E.

Section V
ILS T&E Approach

10-18. ILS Quantification

ILS T&E must quantify the various measures of ILS planning, logistics supportability, and operational suitability. The scope of this effort is described in the following paragraphs.

a. The designated logistics support concepts/system for the hardware or software systems.

b. The growth and maturity of relevant logistics support elements.

c. The impact of relevant logistics support elements on system and unit readiness.

d. The logistics burden imposed on the unit and the support system.

e. The logistics cost.

10-19. Logistics Supportability in the T&E Process

The logistics supportability doctrine, concepts, and organization addressed consider all levels of organic maintenance and supply support. Figure 10-2 illustrates the logistics supportability throughout various phases of the T&E process. Software supportability is considered an ILS assessment item and has to be a testable part of logistics testing. Additional details on software are addressed in Part Seven.

(INSERT FIGURE 10-2)

10-20. ILS Assessment Considerations and Documentation

The methodology used for logistics CE can be tailored to the type and level of the system (ACAT I through IV program), the phase of acquisition, the acquisition strategy (AS), and the impact of the logistics supportability on the suitability of the system.

Figures 10-3 and 10-4 list the various ILS assessment consideration areas and the documentation used or required in the ILS process.

(INSERT FIGURE 10-3)

(INSERT FIGURE 10-4)

10-21. ILS Demonstration and Testing
A logistics demonstration is required to be conducted on most (some ACAT III & IV programs do not) acquisition programs by the PEO/PM/MATDEV. Contractor testing, FDTE, and other testing are also conducted as indicated in figure 10-5. Figures 10-6 through 10-8 describe the evaluator's role through each of the phases/milestones.

(INSERT FIGURE 10-5)

(INSERT FIGURE 10-6)

(INSERT FIGURE 10-7)

(INSERT FIGURE 10-8)

10-22. Responsible Organizations
The following organizations comprise the major players in logistics planning and analysis (figure 10-9). For more information about the functions of these organizations, see Chapter 3.

(INSERT FIGURE 10-9)

10-23. Limitations and Constraints on ILS OT

a. A system's ILS elements are combinations of generic management processes, resource drivers, and requirements that should be completely tested, quantified, and evaluated during any type acquisition process. All ILS elements will be considered even though constraints may be placed on the acquisition system, which will require follow-on testing after initial fielding to assure adequate supportability exists. However, in no case should significant, unresolved supportability deficiencies be allowed to be present at time of fielding.

b. ILS elements being assessed may require the use of the DT data or contractor test data because practical test constraints do not realistically allow the impact of logistics supportability to be portrayed on the receiving units. In these cases,

analysis, modeling, or simulation techniques might be considered to compensate for the inability to perform the actual logistics operation.

c. Any constraints and limitations must be identified early in the acquisition program. Early evaluation results in identification of critical logistics supportability issues, criteria, and data sources.

d. Simulating combat damage to determine logistics impact may not be a capability during OT. The recognition that combat damage seriously impacts war-time logistics support (e.g., higher demand of repair parts, ammunition, and fuel; increased personnel, and special maintenance procedures for battle damage repair kits now being established for new system acquisitions) must be considered and evaluated carefully to assure that the configuration of support units can support wartime operational tempos. Existing or development of new simulation models should be considered in the evaluation process to determine impact on logistics that combat damage causes.

10-24. Role of the Independent Evaluator/Assessor in ILS

a. Independent development and operational evaluators are not responsible for developing, applying, or managing the ILS process and are not the Army's overall evaluator for ILS but do have specific responsibility for:

(1) Monitoring the LSA process.

(2) Monitoring the system supportability characteristics of the system under development.

(3) Conducting necessary DT&E and OT&E to determine system sustainability using the ILS concepts and doctrine established in the acquisition strategy for the system being developed.

b. Throughout the acquisition process, the evaluators have to interact with members of the ILSMT and with the independent logistician (DA DCSLOG) and the MATDEV.

c. Perform on system assessment functions as noted below.

(1) Monitor and report the system's ILS element deficiencies.

(2) Determine the support system's ability to meet the logistics support requirements/criteria established in the

acquisition strategy.

(3) Establishing automation systems that describe in detail all knowledge required to properly analyze impact of ILS in T&E.

Section VI
Readiness

10-25. Operational Readiness Issues

a. For most systems, operational readiness issues are included in T&E planning documents. Operational readiness issues address the capability and capacity of the unit to achieve and maintain the required peacetime and wartime system readiness objectives (SROs) when the planned logistics support concepts, doctrine, and organization (as described in the MNS and the D&OTSP) and materiel (as described in the SSP) are used.

b. The issue is normally limited to the retail (intermediate and below) Army logistics system. In cases where two levels of logistics support are dictated, such as user and depot, the operational readiness issue will include the depot activity. Criteria normally come from the SRO in the ORD.

10-26. System Readiness Objectives (SRO)

a. AR 702-3 requires development of an SRO for each system or item. For most Army systems, Ao has been selected as the element that forms the SRO.

b. For systems or items like clothing, artillery rounds, gas masks, or distributed systems, other measures such as mission reliability or success, percent of critical functions completed, or percent of critical communications sent or received may be better indicators or measures of readiness.

c. SRO are stated as requirements for the IOC time-frame and are to be supported by logistics supportability concepts, doctrine, organization, and materiel. The evaluators assist in justifying and developing SROs by participating in the RRRWG, PDRs and CDRs.

d. The IEP or TEP shows how the SRO will be estimated, how unit readiness will be assessed, and how significant drivers for the SRO will be determined.

e. A representative measure of the SRO is seldom directly measurable from test. Test data do not adequately reflect expected peacetime or wartime field conditions. Certain components of an SRO, such as repair times and failure data, do not reflect typical field usage. These data require "adjustment" through analysis before they can be used appropriately in the evaluation. In these situations, the evaluator should identify both the demonstrated and the predicted SRO.

f. When specific failure modes are corrected and verified with little expectation that they will reoccur with the production item in the field at the same rate, the failure data can be revised in the predicted SRO estimate.

g. When BITE has not been developed and alternative diagnostic procedures have to be used during a test and are not forecast to be the eventual diagnostic procedures, an alternative strategy has to be develop to insure repair times should also be used to reflect the impact.

h. Other components of the SRO, such as ALDT, require more substantial analysis and modification, often using assumptions and methodologies quite different from those used in development of the criterion.

10-27. Unit Readiness Analysis

a. The system and its associated items of support impact on the unit readiness requires extensive analysis. Unit readiness estimates from test seldom reflect the realistic workload on the unit because of sample sizes, equipment configuration, and the amount of contractor logistics support that has to be provided because of the non-availability of organic support.

b. When testing requires dedicated DS/GS/intermediate level maintenance support, maintenance workloads in test normally will be extremely low and will impact on availability of legitimate data on personnel, facilities, TMDE, and other elements of support at this logistics level.

c. A unit readiness analysis based on logistics parameters established during the development process may be extremely difficult and may have to include use of the following data:

(1) Engineering data that includes a complete failure modes analysis.

(2) All accumulated test data that will include any type

testing accomplished.

(3) Personnel and support information that relates to the unit being evaluated.

(4) Current unit workload.

c. The unit readiness analysis typically may require a computer model or simulation that allows supply, maintenance, transportation, and other ILS resources to be consumed and replenished as the unit operates in accordance with the planned wartime or peacetime OMS/MP. Modeling and simulation do not replace the requirement to perform a test, but only assist in making analyses when actual operational data do not exist.

d. Several existing models are useful in this regard.

(1) Army Unit Readiness/Sustainability Assessor model.

(2) Return to Combat model.

(3) TRANSANA Aircraft Reliability and Maintainability Simulation.

e. These models provide readiness estimates such as Ao, days of sustained operation, unit availability, and supply and support resource consumption. They use engineering estimates as well as test data to address the following: mission profiles, support resources, requirements, personnel (i.e., number of personnel by MOS), quantities of tools and tool kits, TMDE, support equipment, and supply support.

f. If a unit-level logistics model is planned for in the IEP or TEP, the following are done early in the system's life cycle:

(1) Identify the model or characteristics of the model to be used.

(2) Identify the organization that will run and maintain the model and database.

(3) Determine the format and sources of the required data.

(4) Ensure that the data are provided or collected in the correct format.

(5) Ensure that the model is accredited.

g. Some low-density or non-repairable systems or items may not require a unit-level logistic model. Other systems or items may require special-purpose models (i.e., transportation or supply).

10-28. Administrative and Logistics Downtime (ALDT)

a. Testing is normally not to be delayed in order to collect data on realtime ALDT. Procedures for onsite repair of damaged or contractor obtained parts are developed by the test director and incorporated into the test plan. These procedures include all anticipated means of acquiring supply support (e.g., local purchase) during the test.

b. During the conduct of the test any artificial ALDT that result from accomplishing repairs or obtaining support that was not anticipated in the established SSP or required to continue testing using any unique support techniques will be documented in such a manner that realistic ALDT are established at test completion for evaluator use.

10-29. Adjustment of ALDT
There are three procedures for estimating ALDT attributable to the PLL/ASL (see figure 10-10). The results can be used in the Ao analysis in place of the actual test data. The three procedures are as follows:

(INSERT FIGURE 10-10)

a. ALDT for supply (PLL/ASL) using estimates and assumptions from the RAM Rationale Report (AR 702-3) may be calculated in lieu of test data provided adequate justification is established.

b. When the PLL/ASL for test is complete and items similar to those being tested are found on existing systems, order and ship times can be estimated from historical data. Given the national stock number (NSN) and appropriate weapon system codes, the LIF of the Logistic Control Activity (LCA) can provide order and ship times (OST) for Europe and CONUS. The OST yields a more representative ALDT than the test ALDT and is more useful for sensitivity analyses on the SRO.

c. When the PLL/ASL for test has incomplete stockage levels and the OST for restocking the PLL/ASL are skewed because of test priorities, the following analysis is effective for making ALDT estimates more realistic. For each mission-critical or high-cost spare and repair part to be analyzed, construct a supply support matrix similar to figure 10-14 using the following methods:

(1) Construct a time-line similar to figure 10-10 and indicate the initial wartime and peacetime stockage level and reorder point for each item.

(2) Plot the stockage level during the reorder period, indicating points where demand occurred with zero stock balance. The result will show a more realistic ALDT estimate that can be used to adjust for contractor repair on site, test continuation, off-system repair, and less than 100 percent initial stockage of the PLL/ASL.

(3) The following data are required and are available from the MATDEV:

(a) A listing of supply support items on the PLL/ASL from the SSP.

(b) Initial wartime and peacetime stockage level for each item.

(c) Mission criticality of each item.

(d) Repair policy for each item.

(e) Resupply and replenishment policy for each item.

(f) Reorder point for each item

(g) Location and mobility requirements

(h) Item weight, volume, and size, and storage vans or vehicle capacity.

(i) Sufficient on-hand quantities of PLL/ASL items for test continuity.

(j) Supply support demands from test.

Section VII
Logistics Burden

10-30. Description
For each testable element of the SSP, a logistics burden analysis is planned in the IEP or TEP and executed in the IER or TER. The logistics burden analysis compares support maintenance, supply,

and transportation demands placed on the support system against the resources planned for the support system.

10-31. ILS Elements Addressed

Each testable element of the SSP is to be addressed to determine the strengths and weaknesses of the planned support in terms meaningful to the decision process. As a minimum, the following elements are to be addressed:

a. Maintenance concept to determine its relationship and integration with Army logistics doctrine.

b. Supply support.

c. Personnel and manpower.

d. TMDE.

e. Tools, tool kits, and other maintenance equipment.

f. Technical documentation.

g. Other support equipment.

h. Training.

i. Facilities reviews to be assured support system will operate within planned construction.

j. Packaging, handling, and storage provisions with special emphasis on ancillary equipment that might be required for movement of packages.

10-32. SSP Requirements

The MATDEV is responsible for ensuring that the required quantities of each element of the SSP are delivered to the test site. All elements of the SSP are to be provided in proportion to the systems being tested. For example, if 6 sets of special-purpose tools are required for a test of 15 systems, then 2 sets of special tools are required for a test of 5 systems.

10-33. Logistics Burden MOP

MOPs and criteria for each element of the SSP are required for logistics burden analysis and evaluation. When these criteria have not been developed by the CBTDEV, the evaluator may be required to develop a set of baseline criteria. MOPs and suggested criteria are presented in the discussion of each support element.

Section VIII
Supply Support

10-34. Elements of Supply Support (AR 710-2)

a. Selected spares and repair parts of the PLL/ASL.

b. Hands-on supplies of on-board spares and repair parts.

c. BII, AAL items, and expendable supplies and materiel (ESM).

d. POL.

e. Ammunition.

f. Items or media that contain software (e.g., disks, tapes, and memory devices).

10-35. Supply Support Categories
To simplify tracking and analysis of the PLL/ASL (see figure 10-10), supply support is divided into the following categories:

a. Mission-critical support (i.e., supply support necessary to sustain the system in combat).

b. Non-mission-critical support.

c. Items common to the unit's existing supply support.

d. System-peculiar items introduced into the unit's existing supply support.

10-36. Supply Support Criteria and MOP
MOPs and baseline criteria for supply support are shown in table 10-1. Data requirements are shown in figure 10-11.

(INSERT TABLE 10-1)

(INSERT FIGURE 10-11)

10-37. Supply Support Considerations
In evaluating supply support, consider the following:

a. Demand and consumption rates. Consumption rates for repair parts, spares, POL, and bulk supplies are critical

logistics supportability readiness and cost indicators. The ability of the supply system to meet consumption requirements significantly affects the readiness of the fielded system. Compare stated criteria to the demand accommodation and satisfaction, direct exchange, and zero balance indexes adjusted from test, and overall supply availability rates.

b. Replenishment and resupply rates. Accurate replenishment and resupply rate estimates for items with demand-oriented replenishment policies normally come from not test data but from the MATDEV. Because these rates may be significant contributors to ALDT, they can be used in system or unit readiness simulations or models.

c. Mobility. The addition of items to the PLL/ASL may critically restrict the mobility of the PLL/ASL by increasing volume without an adequate increase in trailers, trucks, or vans. In addition, items placed into the PLL/ASL may be sensitive to movement and storage conditions. The loading and storage plan may not be compatible with the mobility requirements or the size of new components. The mobility index is measured in test and compared to the stated mobility index criteria or the baseline criteria.

d. Size. The addition of system-peculiar supply support items is not to substantially increase the size of the PLL/ASL. Large increases in the number or size of line items is undesirable. Current or planned storage capability may not accommodate large components or assemblies, or may not be designed to adequately protect components that contain hazardous materials or require special handling and storage. Storage space for personal gear should be available. The volume of the PLL/ASL is measured in test and compared to the available storage volume using the volume accommodation index.

e. Capacity. Current storage layout/supply identification means in the PLL/ASL may not be consistent with the new system. Onloading, offloading, and lifting capacity may not be sufficient for the new items being introduced. Special handling and storage requirements such as refrigeration of batteries are to be addressed. On-board spares and BII are to be readily accessible and not interfere with or pose safety or health hazards to the crew. The PLL/ASL line item index is to be compared with stated criteria. The evaluation addresses the need and practicality of consumption, replenishment, and storage of POL, on-board spares, ammunition, repair parts, tools, AAI, ESM, and BII.

f. Analysis constraints.

(1) Preliminary estimates of supply support requirements are engineering estimates from the LSA process based on projected system usage rates, reliability predictions, and component failure rates.

(2) The utility of supply support data is significantly limited by test constraints and limitations such as duration of the test, limited sample sizes, contractor maintenance, engineering changes and immaturity in the Fault Detection, Isolation, and Location System (FDILS), and software.

(3) Through careful planning and use of engineering and test data, the PLL/ASL can be simulated without interrupting the test. It can be simulated manually or through the use of the analyses suggested in figures 10-12 and 10-13.

(INSERT FIGURE 10-12)

(INSERT FIGURE 10-13)

(4) It may be advantageous to run a POL, ammunition, or PLL/ASL model such as the Selected Essential Item Stockage for Availability Model or the Optimal Supply and Maintenance Model.

(5) Fuel consumption data from test may not reflect the capability of the unit to deliver, store, and dispense the additional fuel for the new vehicles. Use the unit's current capability, the BOIP, TOE, and MPs and consumption rates from test data to determine the additional capability required (e.g., fuel trucks, storage tanks, or dispensing equipment) to accommodate the new system.

(6) Test data, combined with engineering estimates, support the evaluation of supply support through sensitivity, readiness, or logistics burden analyses. See figures 10-12 and 10-13 for analysis examples. Figure 10-14 is an example of a Supply Support Matrix.

(INSERT FIGURE 10-14)

Section IX
Personnel and Manpower

10-38. Personnel and Manpower Elements (AR 602-2)

Maintenance, supply, and other support personnel and their required skills and training are the elements of personnel and

manpower.

10-39. MOP for Personnel and Manpower

a. Maintenance Ratio (MR) is the ratio of maintenance manhours per operating hour or life unit. On and off system MRs are estimated for each level of maintenance and MOS. MR criteria are typically found in the requirements document.

b. Mean Time to Repair (MTTR) is estimated for each maintenance level and for each type of maintenance action, type of repair (e.g., electrical, mechanical), or MOS. MTTR criteria are typically found in the requirements document.

c. Percent maintenance actions at each level of maintenance. Baseline criteria can be taken from the ALDT decision tree in the RRR.

10-40. Data Requirements for Personnel and Manpower
Data requirements for manpower and personnel are given in figure 10-11.

10-41. Evaluation Considerations for Personnel and Manpower
In evaluating manpower and personnel, consider the following:

a. Estimate the expected workload for each operator, maintainer, supply, transportation, and other support personnel MOS, based on test data. Include estimates of--

(1) Preventive maintenance checks and services.

(2) Unscheduled maintenance to include battle damage repair procedures using the Battle Damage Repair Kits.

(3) Operator, supply, transportation, and other support tasks not experienced in test (e.g., quarterly services).

b. Compare these estimates against those identified in the QQPRI (see figure 10-4) to identify shortfalls. This method validates the adequacy of both the maintenance level at which the tasks have been assigned and the MOS selected.

c. For MR, MTTR, and percent maintenance actions at each maintenance level, compare the stated criteria from the requirements document to the adjusted estimates from test.

d. Because most test maintenance, supply, and transportation personnel are dedicated to the test, data collected on manpower

and personnel at higher than organizational level are not likely to provide a realistic estimate of workload.

e. T&E of manpower and personnel supports MANPRINT efforts and vice versa. See figure 10-15 for an analysis example.

(INSERT FIGURE 10-15)

Section X
TMDE

10-42. TMDE Elements (AR 750-43, MIL-STD-1309)

a. All common or general-purpose manual test equipment and ATE. ATE can measure selected parameters of an item using test program sets that satisfy functional tests for those parameters.

b. Selected special-purpose TMDE.

c. The simplified test equipment series of ATE such as the internal combustion engine or expandable (STE-X) at the organizational level.

d. The intermediate forward test equipment composed of a contact test set, base station test facility, and an electro-optical test facility at the intermediate level.

e. The AN/MSM-105(V)2 and AN/USM-410(V)2 as found throughout DS/GS or Intermediate and above levels of maintenance.

f. TPSs, BITE, and calibration equipment.

10-43. TMDE Requirements

TMDE may be acquired under a separate requirements document or in a separate annex to the supported end item requirements document. In either case, it has its own performance, RAM, and logistics requirements. Formal procedures have been established for justifying and acquiring special-purpose TMDE. Each TMDE requirements document, PIP, and TMDE annex to the supported end item has an MNS concept.

10-44. BIT/BITE

BITE is used in fault detection, isolation, or location and involves digital or analog signals, warning and advisory messages, lights, audio signals, or switches. It is usually planned to detect, isolate, or locate a percentage of system

faults to a specific ambiguity group level, LRU, or shop-replaceable unit (SRU) (see glossary for definitions). The evaluation examines BITE effectiveness, software, and growth during system development. BITE data requirements are to be included in instrumentation requirements.

10-45. Testing of TMDE

a. TMDE is allocated to the maintenance levels as specified in the MAC (see figure 10-3). All manual, general-purpose TMDE, and ATE with TPSs will be available as part of the SSP to be used during test.

b. The test will evaluate all TMDE to determine that its capabilities during the required logistics demonstration can be met in the operational environments scheduled for the equipment use. This will require special exercises to include fault insertion events in order to fully evaluate TMDE capabilities.

c. All TMDE, ATE with complete TPSs (including software, interconnecting devices, and documentation) and BIT/BITE will be sufficiently complete to allow full utilization during IOTE.

10-46. TMDE Analysis

See figure 10-16 for an analysis example. MOPs for TMDE are as follows (no baseline criteria are provided):

(INSERT FIGURE 10-16)

a. Probability of correct fault detection. This probability calculation is the ratio of fault indications (correctly isolated to some specified ambiguity group, LRU, or SRU) to the number of confirmed, incorrect, or absent fault indications. It is calculated for each type of BITE, TMDE, or TPS.

b. Probability of correct fault isolation and location. This calculation is the ratio of confirmed faults (correctly located or isolated to a specified ambiguity group, LRU, or SRU) to the number of location or isolation attempts. It is computed for each type of BITE, TMDE, or TPS and includes the measurement of false indications.

c. TMDE utilization rates. This rate is a ratio of the utilization hours of a piece of TMDE to the operating hours of the supported end item.

d. Percent faults detected/located by manual, semiautomatic, and automatic techniques.

e. Time supportability. This factor is the ability of the TMDE to be supported. It includes the TMDE RAM characteristics and adequacy of the system support package required for the TMDE.

10-47. Data Requirements for TMDE
Data requirements for TMDE are shown in figure 10-11.

10-48. Evaluation Considerations for TMDE

a. Evaluate the operational effectiveness, suitability, and supportability of TMDE both quantitatively and qualitatively.

b. Compare the stated criteria to the percent correct fault detection or percent correct fault isolation or location from test or LD.

c. Compare TMDE RAM against the stated requirements.

d. Identify TMDE utilization rates for each piece of TMDE.

e. Address percentage of faults detected, isolated, or located by manual, semiautomatic, and automatic procedures.

f. These are some of the questions that should be answered:

(1) Are sufficient quantities of TMDE located at the proper maintenance levels?

(2) What is the increase in common and peculiar manual test equipment and ATE over the unit's current TMDE?

(3) Are the TPSs compatible with existing ATE?

(4) Will the TPSs be validated and verified prior to fielding?

(5) Are adequate storage areas being provided for the TPS?

Section XI
Tools, Tool Kits, and Other Maintenance Equipment

10-49. Elements of Tools, Tool Kits, and Other Maintenance Equipment
Included are common and special tools or tool kits, jigs, fixtures, stands, lifting devices, and any other type of servicing (lubrication guns, pumps) or maintenance equipment.

10-50. MOP for Tools, Tool Kits, and Other Maintenance Equipment
MOPs for tools, tool kits, and other maintenance equipment are given in Table 10-1. Similar measures can be applied to any maintenance equipment. A design goal is the elimination or minimum use of special tools or tool kits, jigs, fixtures, stands, and lifting devices and maximum use of existing equipment. If new items are required, they are to minimize training and storage requirements. A reduction in reliance on common items is also a design goal.

10-51. Data Requirements for Tools, Tool Kits, and Other Maintenance Equipment
Data requirements for tools, tool kits, and other maintenance equipment are given in figure 10-12.

10-52. Evaluation Considerations for Tools, Tool Kits, and Other Maintenance Equipment

a. Adequacy of all special and common tools, tool kits, and other maintenance equipment needed to perform critical tasks and procedures, including special tools listed in the RPSTL BII, and tools allocated to each maintenance level listed in the SSP, .

b. Location at the appropriate level of maintenance.

c. Availability.

d. Effectiveness.

e. Sufficiency of quantities provided.

f. Ensure that all critical operator, maintenance, and support tasks and procedures can be done using the appropriate special and common tools and tool kits.

g. Evaluate work stands, fixtures, jigs and any other type of servicing (lubrication guns, pumps) or maintenance equipment with respect to ease of use, operating instructions, standardization, and adequacy of numbers and location at each maintenance level.

h. Tools that support a particular system are often consolidated into tool kits. Special tools, even though part of a tool kit, are evaluated separately.

i. When necessary, tailor the evaluation for specific applications (i.e., special tools only or a subset of a particular tool kit). See figure 10-17 for an analysis example.

(INSERT FIGURE 10-17)

Section XII
Technical Documentation

10-53. Elements of Technical Documentation
Technical documentation includes all of the following manuals: operator, intermediate, direct support, general support maintenance, supply support, calibration, handling, storage, and transportation. Also included are separate documents on specific maintenance, special inspections, lubrication, or other instructions.

10-54. MOP for Technical Documentation
MOPs for technical documentation are given in table 10-1.

10-55. Data Requirements for Technical Documentation
Data requirements for technical documentation are in figure 10-12.

10-56. Evaluation Considerations for Technical Documentation

a. Evaluating manuals consists of two distinct tasks. Unless the two tasks are done separately, it may be impossible to determine if the manual is in error or if the user followed the procedures incorrectly. The two tasks are--

(1) Determine if the drawings, figures, specifications, and procedures are technically correct. Do this task during TT, MDs, and LDs.

(2) Determine if the soldier can understand and correctly perform the procedures. This is a most important task for OT. This task includes ensuring that tools, TMDE, support equipment, supply support, and critical tasks are allocated by the manuals to the correct level of maintenance and MOS.

b. As a minimum, all critical tasks and procedures in the operators and intermediate/DS-GS maintenance manuals and in the supply, calibration, storage, handling, or transportation manuals or supporting documentation are to be verified. Operation, maintenance, and support actions that occur naturally in test may be limited and not represent the total set of critical tasks and procedures identified in the critical task listing. Any critical task or procedure that is not demonstrated in the logistics or maintenance demonstration or that does not occur naturally in the

OT will be verified in a separate exercise after the OT.

c. In evaluating technical documentation, cover the following points:

(1) Users' ability to locate procedures and tasks in the manual.

(2) Clarity and accuracy of the manuals.

(3) Need for additional tasks to be included in the manual.

(4) Validity of tasks and procedures that rely on ATE and that are included in backup manuals.

(5) MAC time estimates compared to demonstrated times.

(6) Ready visibility of cautions, warnings, and advisories in the manual.

(7) Validation of and necessity for preventive maintenance checks, services, and procedures and scheduled services.

d. Software documentation is addressed as a separate item because of its criticality.

e. See figure 10-18 for an analysis example.

(INSERT FIGURE 10-18)

Section XIII
Other Support Equipment

10-57. Elements of Other Support Equipment
Other support equipment includes generators; trucks, trailers, and transportation and handling equipment; shop and supply vans; retrieval and resupply vehicles; calibration vehicles; ammunition and fuel trucks; and bridges.

10-58. MOP for Other Support Equipment
No baseline MOPs are provided. Demand is to be accommodated by the amounts stated in the BOIP.

10-59. Data Requirements for Other Support Equipment
Data requirements for other support equipment are given in figure

10-12.

10-60. Evaluation Considerations for Other Support Equipment
To evaluate support equipment (both old and new), compare test data against amounts stated in the BOIP. Adequate early planning will cause sources other than the OT to generate much of the required data. In evaluating, address the following points.

a. The following can be demonstrated in TT using military test players:

(1) Peculiar repair requirements such as grounding straps for electronic repair.

(2) Environmental storage adequacy.

(3) Loading, unloading, and storage capacity of the PLL/ASL.

(4) Onloading and offloading on all authorized transportation modes.

(5) Tiedown and transportation capability.

(6) Compatibility of the fuel dispensing system (i.e., nozzles, pumps, and hoses).

b. Analyze the adequacy of fuel truck increases planned in the BOIP by using the OMS/MP and fuel consumption data from contractor tests.

c. Verify the capacity of a tractor trailer to transport the system by comparing the dimensions, gross weight, and peculiar transportation requirements (i.e., tiedown limitations) of the system to the dimensions of the tractor trailer and its load-hauling capacity.

d. Evaluate ammunition and retrieval vehicles, maintenance support, and handling equipment to ensure that they support their intended functions.

e. Determine the capacity of the supply trucks or vans to store and transport supply support by analyzing the volume of the PLL/ASL, the space available in the existing vehicles, and the increase in the number of vehicles from the BOIP. Supply vans and trucks are to be organized for easy identification of repair parts, spares, and other items of support.

f. The dimensions of a component part may not be compatible with the proposed layout and may require more space than planned.

g. Allocated workspace for the maintenance personnel is not to interfere with the ability of personnel to accomplish required tasks. Commercial graphical computer techniques are available that can show the configuration and layout of the shops and vans. Storage space for personnel gear is to be allocated.

Section XIV
Training

10-61. Elements of Training
Training (AR 350-35) includes training aids, simulators, training materials, instructors, and on-the-job training.

10-62. MOP for Training
MOPs for training include "critical tasks demonstrated." This MOP is the ratio of critical tasks demonstrated by the soldier using validated procedures within the time standard, to the total number of tasks attempted or total tasks in the manuals. It can be calculated for each maintenance level or MOS. Other MOPs for training are developed under MANPRINT.

10-63. Data Requirements for Training
Data requirements for training are collected under manpower and personnel and MANPRINT.

10-64. Evaluation Considerations for Training

a. As a minimum, evaluate the effectiveness of the TRSP with respect to any existing or new critical tasks required of the maintenance, operation, transportation, supply, calibration, or support personnel or the contact teams. As a minimum, the operators and maintainers are required to perform all the critical operator and maintainer tasks.

b. Address unit and individual training through the intermediate and DS/GS level.

c. Address ICTPs, POIs, and any other training-related documentation, devices, and aids.

d. When possible, plan for maximum use of data from training simulators, mockups, and other innovative training concepts.

Section XV
Transportability

10-65. Elements of Transportability

a. Transportability (AR 70-44, AR 70-47) includes the ability to move the system into a theater of operations-strategic, and move it within the theater of operations-tactical consistent with the mission. This element may deal with airplane, train, or ship loading and internal or external helicopter loads. This focus will allow the evaluator to determine if the system is deployable.

b. Transportability is a major consideration in the T&E of Army systems, including system components and spare parts. T&E of transportability will address the end-item in its tactical and packaged or shipping configurations, as well as associated support equipment and TMDE.

c. Transportability T&E is required as part of developmental testing. The ability of a system to withstand the expected transport environment over the useful life of the system must be demonstrated T&E before the production decision. Transportability characteristics of systems will be assessed and included in the developmental IER.

d. It is also appropriate to evaluate transportability during OT. Soldiers that normally prepare the system for movement should be used during these tests under realistic conditions.

10-66. MOP for Transportability
MOPs for transportability may be questions of the following types:

a. Can the system be transported to the theater by the preferred means?

b. Are assets available?

c. Can the system be moved adequately within the theater of operations?

d. Are dimensions and weight under required limits?

10-67. Evaluation Considerations in Transportability

a. Evaluate not only the ability to carry the load, but also the availability of the mode of transportation.

b. Also ensure that the weight and dimensions of the new system can be supported by the current bridging (including tactical bridging) and transportation network in the required operational environment.

c. For large systems such as vehicles the major source of evaluation information for transportability is MTMC. As the Army's transportability agent, MTMC provides transportability approvals or recommendations for correcting deficiencies on new systems.

d. Most of the airlift, sealift, and rail transportation requirements are documented in AR 70-47. The evaluator should ensure MTMC or other approved agency conducts a transportability assessment. For smaller systems the analysis may consist of assessing the unit's capability to carry the new system in addition to the required load.

Section XVI
Logistics Cost

10-68. Requirements for Logistics Cost Analysis

Cost requirements and considerations are mandated by AR 702-3, DODI 5000.2, and the VCSA message of April 1986 revising RAM policy. The independent operational evaluator incorporates a logistics supportability cost issue in the TEP when logistics supportability or operation and support (O&S) cost criteria exist in the requirements document or when high-cost supportability considerations are identified.

10-69. Logistics Cost Criteria

Criteria for the logistics supportability issue are stated as logistics support or O&S cost parameters and are compatible with the cost criteria in the requirements document. These requirements are to be stated (in dollars) as cost per repair or repair part, or as maintenance manpower cost per year per division.

10-70. Logistics Cost Methodology

a. Logistics supportability and O&S costs are major considerations during system design, development, and acquisition and emphasis is on the reduction of these costs before and after

system fielding. The IEP or TEP describes how the cost criteria will be estimated from T&E data.

b. Cost data (in dollars) usually come from engineering estimates provided by the MATDEV. In addition, the independent operational evaluator identifies and reports any potential high-dollar logistics support or O&S costs uncovered during system T&E. These cost considerations are identified and reported in the IER. For example--

(1) Evaluation may reveal need for more supply vans than identified in the BOIP. This increase may indicate a substantial investment cost for the Army.

(2) Test data may indicate that high dollar repair parts are experiencing failure rates higher than anticipated or that substantially more maintenance personnel of a particular MOS are required.

c. Figure 10-19 is an example of an analysis for determining logistics costs.

(INSERT FIGURE 10-19)

Section XVII
ILS Considerations in Test Planning

10-71. Test Concept

The test concept addresses the planning necessary to fully test and evaluate the SSP, how the logistics support concepts and doctrine will be employed during the test, the type, level, and degree of realism needed to adequately demonstrate the support concept is suitable to the Army in combat, and the test conditions or factors that may affect the logistics supportability of the system (e.g., ALDT). Figure 10-20 is a sample of a data source matrix for logistics issues.

(INSERT FIGURE 10-20)

10-72. Logistics Support Guidelines for Test

During conduct of the test, the logistics support concepts, doctrine, organization, and materiel are to be played as realistically as possible. Unit SOPs for maintenance and support are developed and incorporated into the test. The following test elements are to represent the anticipated field environment to the maximum extent possible:

a. Maintenance and support facilities.

b. Location of supply, transportation, and support personnel and equipment.

c. Maintenance, supply, and support tools and tool kits, jigs, fixtures, stands, lifting devices, and pumps.

d. Use of contact and calibration teams. If contact teams are part of the maintenance concept, they are to be played in test with the appropriate vehicles, maintenance, and test equipment.

10-73. Selective Logistics Play

At direct support and higher maintenance, sometimes only selected functions of supply and support may be played realistically (see figure 10-21 for an example of typical logistics functions). Intermediate, Direct, and General support maintenance personnel are played with an evaluation made even if they are dedicated to the systems in test. If all levels of support are realistically played, additional supportability testing will be done.

(INSERT FIGURE 10-21)

10-74. System Support Package Testing

TT and OT will not be initiated unless a complete SSP is available or formal SSP waiver has been granted. Waiver procedures for the SSP are provided in AR 700-127. The regulation states that using the SSP solely on an "as needed basis" to support the system under test is not acceptable. The SSP is considered part of the system under test. The DTD for logistics inventories the SSP and notifies the independent evaluator and MATDEV of deficiencies or missing items.

10-75. Supply System Testing

Supply support is to be representative of the military support system unless precluded by test or test unit limitations. In those cases where the contractor maintains the supply support system, complete data collection will be accomplished to allow for evaluation. The test organization assures that the contractor's input does not unfavorably affect the established logistics support concept, and, the supply support concept mirrors the established logistics support concept approved for the system.

10-76. Support Equipment Testing

Support equipment and personnel are provided as part of the SSP in proportion to the systems under tests. Recovery, refuel, rearm, transportation, and other procedures and vehicles for test

are to be identified in the IEP or TEP and will be generally be part of the SSP if the equipment being tested requires these functions to operate efficiently under combat conditions.

10-77. Support Package Completeness
Before test, the MATDEV (per AR 700-127) provides a list of the peculiar mission-critical spares and repair parts of the PLL/ASL, including planned stockage levels, replenishment policies, and quantities of items for test. One hundred percent stockage of the PLL/ASL is not required for test, if accounting procedures are established to reconstruct performance of the PLL/ASL at 100 percent stockage. However, sufficient stockage levels, replenishment policies, spares, and repair parts are required for test continuity. Bulk items like common bolts, tape, or fasteners cannot be efficiently addressed in test.

10-78. Maintenance Considerations in Test

a. During IOTE or activities that provide input for consideration during full-production decisions for major acquisition programs, the system contractor personnel cannot participate except to the extent that they will be involved in the operation, maintenance, and other support of the system when it is deployed.

b. If contractor maintenance is part of the maintenance organization and concept, it can be played in test. When the contractor is involved in system maintenance, procedures are to be developed to exercise and control these maintenance functions. The soldier maintenance and support personnel will be afforded the opportunity to maintain and support the system without contractor interference. At no time should the contractor be involved in the maintenance or support of the system unless authorized by the TEP or by the SSP.

c. Use of contractor-peculiar items that will not become part of the support package to be fielded will not be used unless specifically approved by the TEP to ensure that the function the peculiar equipment is required for is included in the LSA/LSAR. If peculiar contractor items are used, they must be authorized in the technical data package.

10-79. Controlled Substitution in Test
Controlled Substitution, formerly described as cannibalization, is not an acceptable means of obtaining support during OT and is used only when all other alternatives are exhausted and unacceptable delay of test results. If controlled substitution is done, it is to be done under the control of the DTD for

logistics. Data collection procedures are to be developed to specifically identify and document all substituted parts and systems with adequate reporting procedures established for the evaluator's use after test.

10-80. Logistics Supportability Testing Deficiencies

a. Sometimes because of test schedule constraints, shortage of some SSP items, and unavailability of the prime test item, some of the sustainment/supportability functions may be delayed or postponed during some periods of OT. Critical tasks, TMDE, and other support equipment may not be demonstrated with soldier interaction during the test.

b. When this occurs during the OT test period, the DTD for logistics will require that the CAPSTONE logistics functions necessary to properly evaluate the system's sustainability/ supportability be tested prior to the completion of OT. These tests are not to be considered as additional tests or exercises but required to insure that all critical supportability tasks have been investigated. These will normally involve the demonstration of critical tasks and diagnostic procedures by using inserted faults, removals, teardowns, and use of special tools or TMDE by soldier. The DTD for logistics determines when such delayed or postponed tests/exercises have been completed based on the emerging results of OT process.

c. If it is determined by the DTD for logistics that inadequate supportability testing has been performed or is not scheduled, the DA DCSLOG'S independent logistician (AMSAA) will be advised and a risk analysis be accomplished and presented at the milestone decision review. This will include all acquisition systems.

Continuous evaluation objectives for logistics supportability.

The CE objectives for logistics supportability are to--

a. Ensure that the ILS assessment considerations are compatible with any type of operational testing.

b. Identify, track, and report logistics supportability deficiencies and shortcomings.

c. Test the system's logistics support concepts, doctrine, organization, and hardware and ancillary materiel in the intended operational environment.

d. Provide continuous evaluation of the system throughout its life cycle and provide data found during the CE process to Army Activities involved with the system.

Figure 10-1. ILS Continuous Evaluation Objectives.

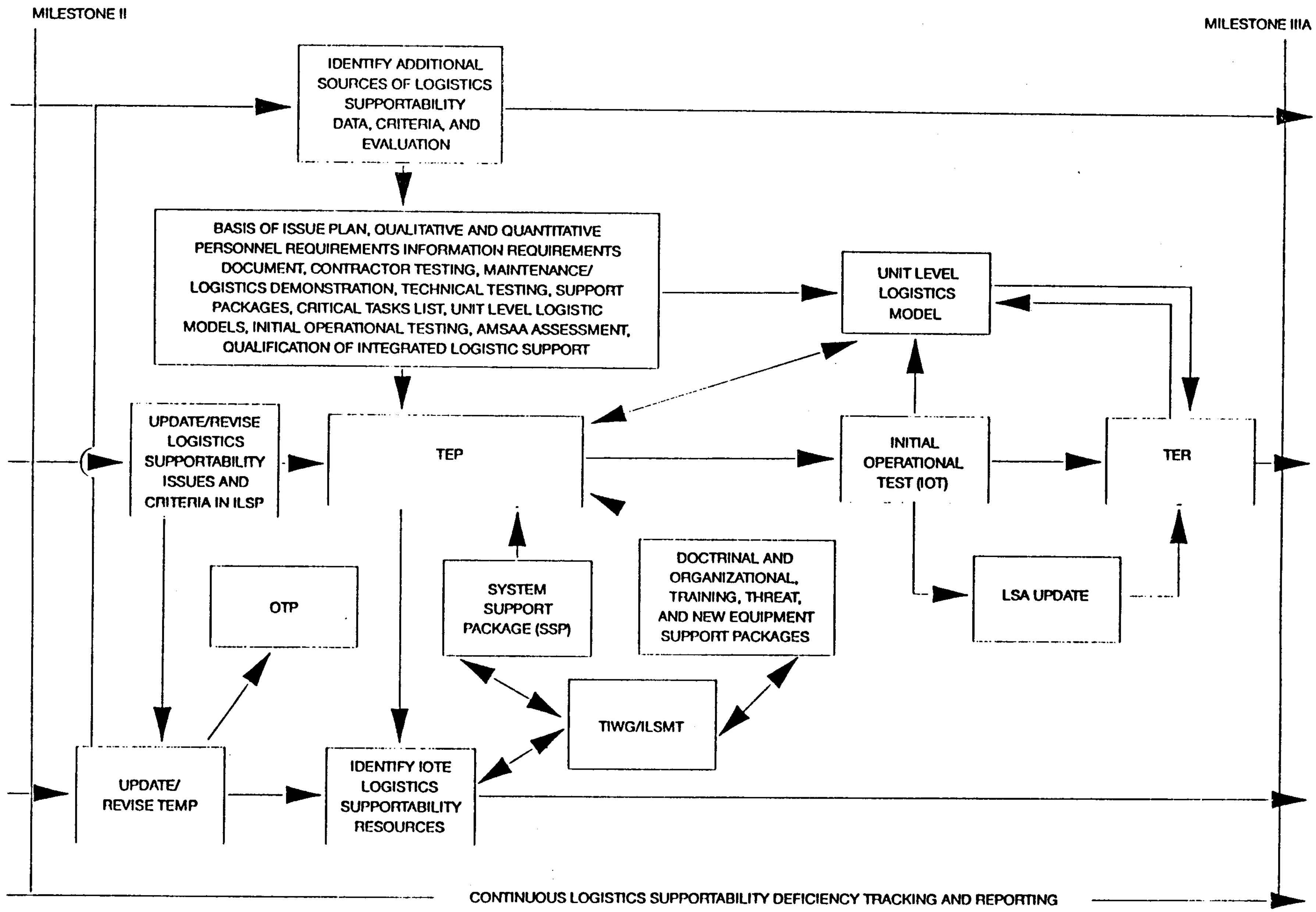

Figure 10-2 (cont). Logistics supportability in the T&E process.

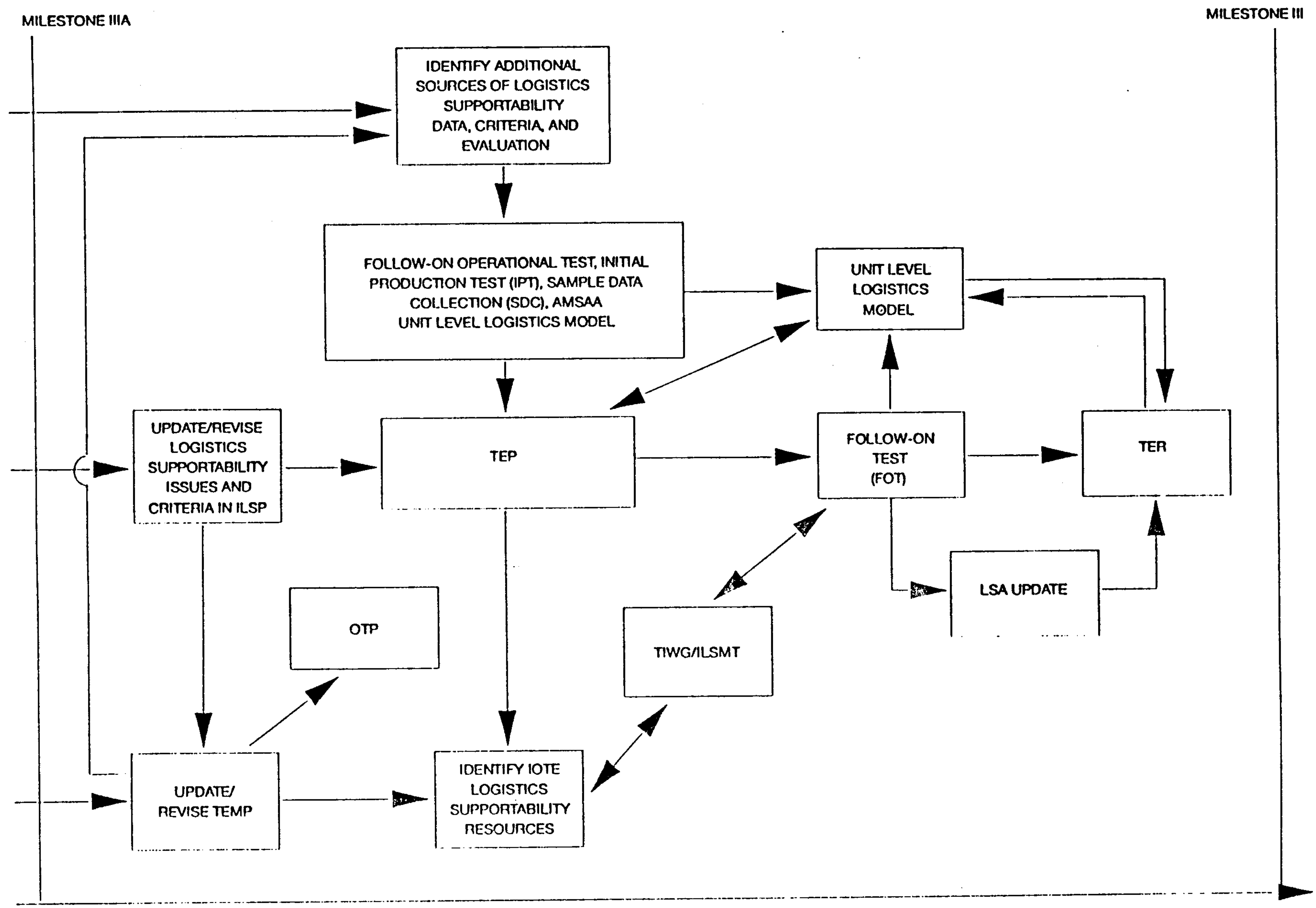

Figure 10-2 (cont). Logistics supportability in the T&E process.

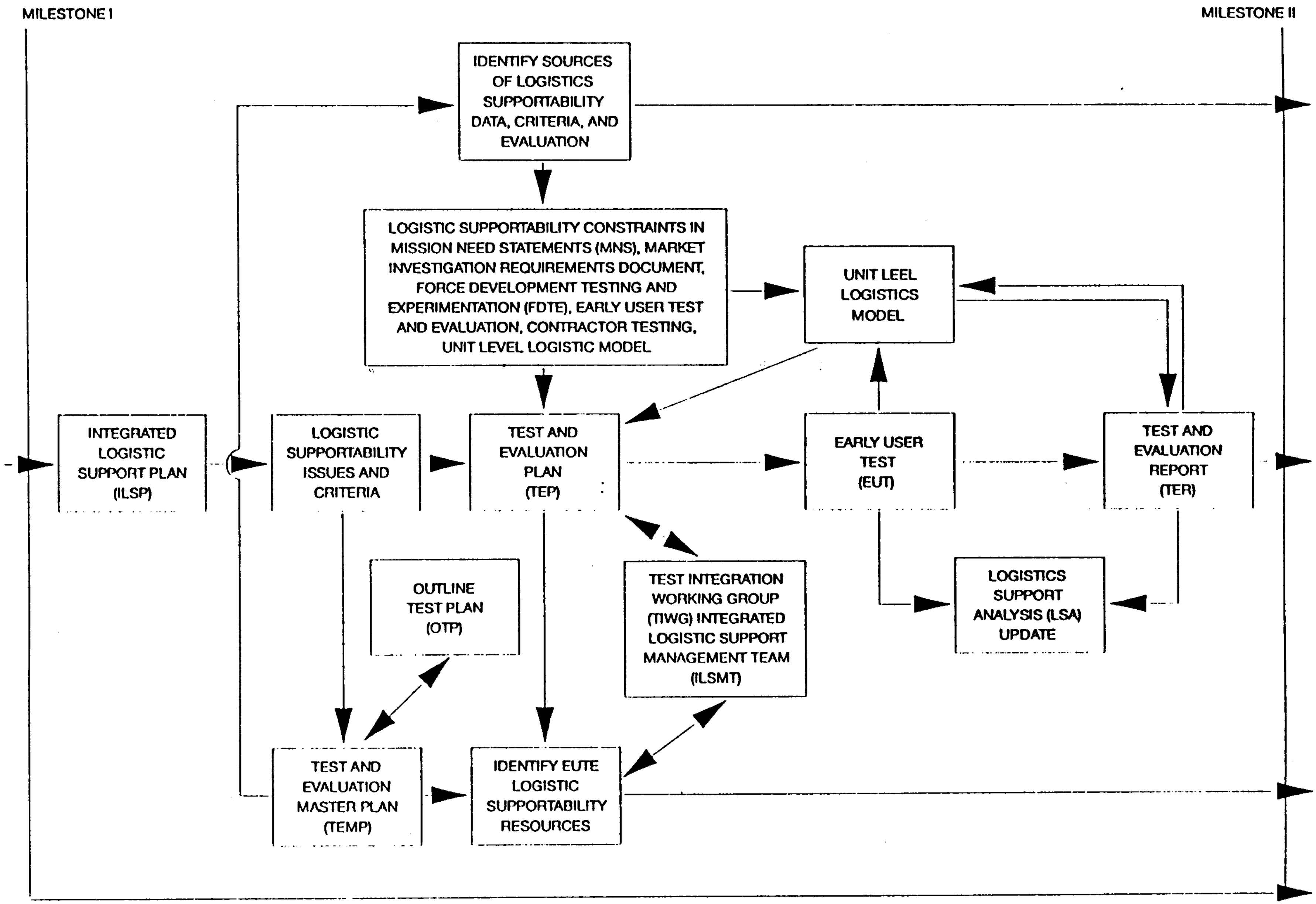

Figure 10-2. Logistics supportability in the T&E process.

ILS ASSESSMENT CONSIDERATIONS:

(1) Design Influence.

(2) Maintenance Planning.

(3) Manpower and Personnel.

(4) Supply Support.

(5) Packaging, handling, and storage.

(6) Support Equipment and TMDE.

(7) Training and Training Devices.

(8) Technical Data.

(9) Computer Resources Support.

(10) Transportation and Transportability.

(11) Facilities.

(12) Standardization and Interoperability.

(13) RAM.

(14) Support Management and Analysis.

(15) Cost Analysis and Funding.

(16) Materiel Fielding Planning.

(17) Environmental.

Figure 10-3. ILS Assessment Considerations.

ILS DOCUMENTATION

a. Documentation.

(1) Associated Support Items of Equipment (ASIOE). ASIOE are not normally a part of the developed system however under total package fielding concepts these items do become part of the complete system to be tested. They are usually listed in the technical manuals but are authorized by the common tables of allowance (CTA), Table of Organization and Equipment (TOEs), or Joint Tables of Allowance (JTA). ASIOE lists contain a description and the authorized quantity of the materiel.

(2) Authorized stockage list. See (13) below.

(3) Basic issue items. BII are authorized for issue as a component of the item. Spares and repair parts are not normally included as BII. BII are those minimum essential items, common and special tools and TMDE, repair parts, publications, first aid, and safety-elated equipment required by the operator or crew to--

(a) Place the end item in an operational status.

(b) Cause an end item to function as intended.

(4) Basis of issue plan. The tentative BOIP (AR 71-2), prepared by the CBTDEV, is submitted with the requirements document and predicts the number of new systems, associated items of support, and personnel required in a unit as a result of the new or modified equipment. It identifies items to be included in the TOE, CTA, JTA, and tables of distribution and allowance (TDA). The final BOIP is submitted 32 months before the FUED.

(5) Critical task listing. The critical task listing (AR 611-201, AR 611-1, AR 71-2) is the CBTDEV and MATDEV's list of critical operator, maintenance, transportation, supply, and other support tasks.

(6) Expendable supplies and materiel (ESM) list. ESM are the items needed to operate and maintain the end item. The ESM list gives a description, unit of measure, and lowest level of maintenance that requires the item.

(7) Integrated logistics support plan (AR 700-127, DA PAM 700-55).

Figure 10-4. ILS Documentation.

(8) Logistics Intelligence File (LIF). This file is located at Presidio, CA, and contains information on order and ship times for systems, items, subsystems, components, and assemblies. It is a source of data for ALDT estimates.

(9) Logistics support analysis (MIL-STD-1388-1A and 2A, AR 700-127, para 113-7a).

(10) Lubrication orders (LOs). The LOs prescribe cleaning and lubrication procedures, proper materiel for lubrication, lubrication intervals, and locations of fittings and oil holes.

(11) Maintenance Allocation Chart. The MAC reflects a materiel system's maintenance plan and is the overall guide to the selection and allocation of maintenance functions, spares, repair parts, tools, and test equipment to various maintenance levels. The MAC identifies the specific maintenance functions (e.g., inspect, replace, repair,) that each maintenance level is authorized to perform. It also establishes a time standard for each maintenance function authorized on a functional group entry. The tools and test equipment required to perform the maintenance function are also identified in the MAC. The MAC is published in technical manuals containing organizational or Aviation Unit Maintenance (AVUM) instructions.

(12) Operational Requirements Document (ORD).

(13) Prescribed load list, authorized stockage list, essential repair parts stockage list (ERPSL), Mandatory Parts List (AR 710-2). The PLL and ASL may appear in separate listings. A repairable exchange is usually established as part of the ASL. The PLL (organizational) and the ASL (intermediate and direct support) give--

(a) Range and quantity of spares and repair parts to be stocked.

(b) Expected item usage.

(14) Preventive maintenance checks and services (PMCS). PMCS are the crew or operator checks and services before, after, or during operation that are prescribed in the operator manuals (-10 series) to help retain the system in, or restore it to, operable condition. PMCS at levels above crew or operator are found in the higher level technical manuals.

Figure 10-4. ILS Documentation (cont'd).

(15) Qualitative and quantitative personnel requirements information (QQPRI) (AR 71-2). The initial QQPRI, drafted by the MATDEV and submitted by the CBTDEV, is a compilation of specified Doctrine and Organization(D&O), training, and personnel information on new or modified materiel systems. This information is used to establish or revise military occupational specialties (MOS) or additional skill identifiers (ASI) and to plan how the required numbers of trained personnel will be provided to operate and support the system. The initial QQPRI is prepared and submitted with the BOIP feeder data at the time the materiel requirements document is prepared, and it is verified during full-scale development. The QQPRI lists:

(a) Personnel duties and tasks.

(b) Work units.

(c) Performance standards.

(d) Manpower authorization factors.

(e) Recommended MOS, ASI, skill levels, and organization.

(f) Recommended personnel skills within current, revised, or new MOSs.

(g) Predictions of direct productive annual maintenance manhours.

(h) Number of direct operators.

(i) Quantity of systems to be delivered by fiscal year.

(j) Descriptive listing of duty positions required for operation and support.

(k) Suggested MOS from which personnel can be obtained for new or revised MOS.

(l) Knowledge, skills, and implications for future personnel and training.

(16) Repair parts and special tools list (RPSTL). The RPSTL illustrates and lists spares and repair parts, special tools and test equipment, and other special support equipment that is required to maintain an item. The RPSTL supports the MAC

Figure 10-4. ILS Documentation (cont'd).

and lists special tools and TMDE, special support equipment, spares, and repair parts. The RPSTL is published as a separate manual or as part of a maintenance manual that may cover one or more levels of maintenance.

(17) Support packages.

(a) System Support Package- Materiel and logistics support that has been established by the Materiel Developer's Logistics Manager that is required to assure the system can be sustained in the field. This support package forms the basis for determining whether the system can be sustained by the maintainers and receives rigorous operational test and evaluation.

(b) Test Support Package- This is the bill of materiel necessary to complete the necessary tests to determine suitability of the system. All of the materiel contained in this package generally is not tested, since much of it will not be fielded with the production system. However, it can provide the tester with some vital information.

(18) System supportability assessments. The independent logistician is responsible to assess for the Department of Army Deputy Chief of Staff for Logistics all systems to determine whether the Army's Logistics System is established correctly to ensure that sustainability in wartime can be achieved. These assessments are the responsibility of AMSAA who reports directly to Department of Army and are maintained on one consolidated data base.

(19) Test program set (TPS) management plan. Test Program Sets involve the hardware and software necessary to interface with automatic test sets used to diagnose electronic components by the logistics personnel in the field. Testing of the TPS's that are established by the TPS management Plan is essential to achieve adequate logistics support for electronic systems that require use of automatic test equipment.

Figure 10-4. ILS Documentation (cont'd).

ILS DEMONSTRATION AND TESTING.

(1) Contractor testing (AR 73-1). During all system development and before any UT, contractor's data may provide insights such as form, fit and function,location and assessability to components and line-replaceable units (LRU), complexity of the maintenance procedures, requirements for special tools, peculiar TMDE, peculiar support equipment, additional facilities and handling equipment. Two reviews of contractor's testing and design; the Preliminary Design Review and the Critical Design Review provide the essential information on which supportability and testability decisions should be made.

(2) Force development test and experimentation (AR 73-1). FDTE is used to verify the logistics supportability doctrine, concept, and organization found in the ORD and the DOSP. It also provides data on selected support elements such as common tools and tool kits, stands, fixtures, and TMDE, and information on the required skills of the maintenance, support, transportation, and supply personnel.

(3) Logistics demonstration and maintenance demonstration (MD) (AR 700-127, DA PAM 700-50).

(a) An LD is the nondestructive operation (tear down if required) and maintenance of a developmental prototype system or end item and its maintenance-significant support and test equipment. It is performed to evaluate the achievement of maintainability goals and the adequacy of the SSP. A maintenance demonstration (MIL-STD-471) and physical and functional configuration audits may be scheduled to coincide with the LD.

(b) The LD is conducted in an environment that duplicates, as closely as practical, the expected operational and maintenance conditions in the field. This environment is to be representative of the working conditions, tools, support equipment, supply support, facilities, and equipment publications that would be required and available during operational service use at the level of maintenance defined in the MAC. This rest will utilizes target audience maintenance personnel which are TRADOC school trained on the system. This demonstration serves to certify the training that normally is contractor provided.

(c) The LD is performed sufficiently in advance of major TT and OT to permit certification and finalization of the SSP.

Figure 10-5. ILS Demonstrations & Testing.

(d) A logistics demonstration is required to be conducted on most (some ACAT III & IV programs do not) acquisition programs by the PEO/PM/MATDEV. Normally an LD will be conducted prior to the production decision. If the LDA is not conducted prior to the production decision, the acquisition decision approval authority is required to grant a waiver for it to be conducted following the production decision. This will often happen in the case of NDI acquisitions or modifications to existing equipment.

(4) Operational testing (AR 73-1).

(5) Sample data collection (AR 750-37).

(6) Technical and operational test training. This training provides the knowledge necessary to use the technical documentation, special and common tool kits, TMDE, maintenance and support equipment, and other ILS functions applicable to the system planned for test. Test players are trained using the designated support materiel. If the designated support materiel is not available and training is impacted, the independent operational evaluator will assess the impact in coordination with the MATDEV, who develops alternative training to insure that a proper test can be performed.

(7) Technical testing. TT provides system-level data on all the ILS elements addressed in AR 700-127. The data developed during technical testing normally provides data about the system that is needed by the operational tester to develop a test that assures the system is suitable for the eventual user. It is extremely important for the developer of the OTP to participate in the acquisition meetings before and during the technical testing to assure all system peculiar requirements applicable to the user are known and tested to meet the COIC.

Figure 10-5. ILS Demonstrations & Testing (cont'd).

Figure 10-6. ILS Considerations in the concept exploration and demonstration and validation phases.

This section is written for the independent operational evaluator. The OT&E process for logistics supportability between MSs I and II is illustrated in figure 10-1.

a. Integrated logistics support plan.

(1) At MS I, the MATDEV initiates an ILSP (DA PAM 700-55). The ILSP describes the planned ILS program and addresses the total integrated logistics support system that includes all the ILS elements and assessment considerations. Section 2.b of the ILSP contains the logistics supportability T&E concept, objectives, scope, and ILS issues.

(2) The ILS assessment considerations are generated by the LSA process and are typically qualitative statements contained in the requirements documentation such as the MNS and the ORD. They are developed in coordination with the CBTDEV, logistician (see para 10-3), and the independent operational and technical evaluators and are updated at each MS.

(3) Review the T&E section of the ILSP to ensure that critical OT&E issues are identified and resources are available for test. Include these issues in the TEMP and ensure that they are covered in the operational TEP.

b. Identifying critical logistics issues.

(1) Identification of requirements imposed on the logistics system by the design (and vice versa) are critical to insuring O&S costs established in the requirements documentation are met. These requirements and in some cases constraints are best determined through attention to the following acquisition processes.

(a) Review draft requirements documentation and attend ORD joint work groups to include RRRWG.(AR 702-3)

(b) Become a full time member of the ILSMT and review LSA processes.

(c) Become a member of the Preliminary Design Review Team and the Critical Design Review Team. These acquisition program reviews are considered extremely important because the configuration of the equipment that will be tested and evaluated is established.

Figure 10-6. ILS Considerations in the concept exploration and demonstration and validation phases.

(2) Some examples of ILS issues that may be unrealistic:

(a) "No increase in maintenance personnel" may be an inappropriate issue if a new system will not replace an existing system and there is no planned reduction in current maintenance workload.

(b) "The system is to be supportable by DS maintenance", the level of organic support is decided by the LSA process and normally not predetermined at the beginning of the acquisition."

(c) "The system is not to require unique test or support equipment."

(d) "The system is to be transportable by existing rail and air inventory assets."

(3) Examples of typical ILS issues listed above that might place constraints on the logistical support system being developed must jointly be addressed by members of the acquisition community in early assessments especially by the designated independent logistician and the operational test evaluator. The early assessments will address as a minimum address the considerations listed below as well as others that might be raised by any member of the acquisition team.

(a) Are the constraints realistic and appropriate for this type of system?

(b) Do the constraints reflect current logistics doctrine?

(c) Will the constraints unnecessarily limit the system design and/or the logistics design?

(d) Will the constraints unnecessarily preclude the application of state-of-the-art advances in system hardware, software, and support concepts?

(e) Will constraints unnecessarily limit effectiveness and suitability?

(f) Will the planned logistics support concepts, doctrine, and organization conform to the Army Standard Logistics System? (AR 750-1 , AR 710-2)

c. Mission Needs Statement.

Figure 10-6. ILS Considerations in the concept exploration and demonstration and validation phases (cont'd).

(1) The MNS identifies the types of operational unit and its basic organizational structure that will operate and support the system. It will establish general guidelines for materiel support concepts, readiness objectives and begins the ILS process.

(2) The MNS review is required to identify inconsistencies between current or planned logistics support doctrine and organization, and the Army Logistics System in place for the type system being developed.

d. Early supportability testing.

(1) Plan EUTE to uncover potential logistics supportability problems. Effective EUTE uncovers deficiencies such as components located in areas inaccessible to maintenance personnel, requirement for unique or additional test equipment, nonstandard components of any type, and establish the baseline for the logistics demonstration to be conducted prior to IOTE.

(2) FDTE is beneficial in the test process to provide essential data on logistics support doctrine, concepts, and organization.

e. Early modeling. Determine whether any logistics model can be effectively utilized during early evaluation and testing. If one is deemed to be useful the following should be identified concerning use of models.

(1) Type of model such as the logistics level to be analyzed.

(2) The model's characteristics.

(3) The source to build the model (or the existing candidate model).

(4) The organization to run and maintain the model.

(5) The resources needed to support the application.

Figure 10-6. ILS Considerations in the concept exploration and demonstration and validation phases.

Figure 10-7. ILS considerations in the full-scale development phase.

a. Logistics Support Analysis (LSA/LSAR)process.

(1) Following MS II with the finalization of the requirements documentation, LSA becomes important with LSAR generated during this phase. LSA considers design trade off, ILS trade off analysis, allocation of tasks, MANPRINT Validation, selection and allocation of Repair Parts, and generally validates all the supportability disciplines established by the ILS process.

(2) Some of the generic analysis used to justify and document the logistics support requirements are listed below. The specific tasks and analysis requirements are discussed in MIL-STD-1388-1A and MIL-STD-1388-2A. The Materiel Developer has the responsibility to ensure contractor compliance with LSA requirements.

(a) Have logistics supportability constraints and alternative support concepts been incorporated into the LSA?

(b) Have LSA tradeoff, risk, and sensitivity been analyzed effectively?

(c) Have logistics supportability goals and objectives been set, justified, and reflected in the system design?

(d) Do the RAM and LSA processes support each other?

(e) Is there a feedback loop among the system design, the T&E processes, and the LSA processes?

(f) Have logistics support concept, organization, and doctrine been developed?

(3) All members of the acquisition community should provide feedback to the LSA process by reporting uncorrected logistics supportability deficiencies to the MATDEV. As LSA data becomes available, the CBTDEV updates:

(a) The BOIP.

(b) The QQPRI.

(c) The logistics doctrine, concept, and organization.

Figure 10-7. ILS considerations in the full-scale development phase.

b. Operational Requirements Document (ORD).

1) The ORD contains an assessment of the development of--

(a) Quantitative logistics support parameters.

(b) Baseline logistics support concepts.

(c) Potential logistics problem areas.

(d) Preferred limits on the need for logistics support element resources.

(e) Current and projected changes to pertinent logistics systems and procedures.

(f) Environment that the logistics is required to operate in.

2) ORD and its logistics parameters are updated at each milestone decision.

c. Operation of the Integrated Logistics Support Management Team (ILSMT) and the Test Integration Working Group(TIWG).

1) The ILSMT and the TIWG are two of the principal acquisition teams that are used to ensure supportability is adequately tested during the acquisition process and the appropriate supportability is on hand at IOC. Close coordination is required between the two acquisition disciplines to insure:

(a) LSA reviews are conducted as required and LSAR requirements are delivered by the contractor.

(b) That all logistics issues are identified with resolutions established and corrective actions(FIX ,TEST, FIX) are taken prior to IOC to ensure appropriate sustainability exists.

(c) That test and evaluation is scheduled, properly resourced, and funded to investigate the planned logistics support for all systems being acquired to support Army operations. Detailed methodology to support the T&E process is quantified and documented in the ILSP, Contractor's ILS SOW, and the TEMP.

(d) Assist the Materiel Developer's ILS manager and T & E manager with planning, scheduling, and providing timely US Government inputs into the acquisition process.

Figure 10-7. ILS considerations in the full-scale development phase (cont'd).

d. Request for proposal.

1) Ensure that the ILSMT and TIWG directions are clearly stated so that the contractor can establish for the US Government an organic logistics support system at IOC that does not rely on contractor logistics support.

2) Ensure that all ILS assessment elements with necessary clarification have been included to enable the contractor to prepare a response that will provide a suitable logistics support system.

3) Establish parameters in the ILS Statement of Work (SOW) that will allow the contractor to use all available design options; current and known advances in logistics engineering to develop a logistics support system that will guarantee O&S costs as established by the acquisition strategy that will also provide a support system suitable for the target audience.

e. Logistics modeling.

1) If any logistics model is to be used in the evaluation process or to support operational testing, ensure that contractor, TT, and OT logistics supportability data are made available to the organization running the model.

2) Organization operating the model will be provided the level of analysis and sensitivity excursions required to enhanced the IOTE.

f. Issues and criteria.

1) Logistics supportability issues and criteria will be developed from the logistics baseline established in the MNS and ORD by the CBTDEV in coordination with MATDEV, TT, OT, the Independent Logistician, and other members of the acquisition team as required.

2) COIC's relating to sustainability will be refined, justified, and completed normally by TIWG and ILSMT actions and incorporated in the ILSP and TEMP. The SOW provided to the contractor will contain sufficient details to assure that his design supports the COICs.

3) If the logistics supportability issues provided by the CBTDEV and the Independent Logistician are not adequate to support the anticipated evaluation or are without quantitative criteria, the independent operational evaluator will

Figure 10-7. ILS considerations in the full-scale development phase (cont'd).

incorporate generic logistics issues and baseline criteria. The baseline criteria are to quantify logistics supportability in terms of impact on system and unit readiness, RAM, logistics burden, and cost burden.

4) Development of additional logistics issues will be done with the assistance of the Integrated Logistics Support Division in the Science and Engineering Directorate of OEC, HQ OPTEC. Figure 10-2 shows a sample data source matrix for the required logistics issues.

g. Test and Evaluation Master Plan. Identify in the TEMP the logistics supportability resources needed for IOTE. Part IV (OT&E outline) of the TEMP includes the logistics supportability issues from the ILSP. If the logistics supportability issues are not considered adequate, then the provisions of paragraph f (4) will be applicable. Although early TEMPs (i.e., MSs I and II) may contain few quantitative criteria, they should contain the system readiness objective (SRO) from the MNS.

h. System support package.

1) AR 700-127 mandates that the SSP be considered as part of the system and that it be tested and evaluated during TT, OT, FAT, and FOT&E. Logistics supportability I&C, DRs, and MOPs are to be developed for each SSP element. A preliminary SSP listing is available 18 months before the start of TT or OT. The final SSP listing is provided 14 months before the start of TT or OT. The actual SSP will be in place 30 days prior to test start.

2) SSP's must be reviewed for completeness, timeliness, and consistency with current approved Army logistics support concepts, doctrine, organization, threat, and training materiel to ensure that the planned resources are provided and can be tested adequately. Report inconsistencies to the MATDEV, CBTDEV, and the Independent Logistician for resolution. If the SSP deficiencies cannot be corrected, it is mandatory that a request for a waiver be submitted I/A/W provisions of AR 700-127 to HQDA(DALO-SM), Washington D.C. 20310-0547. Waiver action is only given for the most compelling reasons because it is imperative that all known support deficiencies will be corrected prior to fielding (FUE/IOC).

i. Test and Evaluation Plan (TEP). The TEP (see chap 3) is the principal planning document for the evaluation of

Figure 10-7. ILS considerations in the full-scale development phase (cont'd).

logistics supportability. It defines critical operational logistics supportability issues, MOPs, DRs, and associated evaluation and analysis planning necessary to ensure that the issues are adequately answered before each MS decision. The TEP will contain plans to evaluate all ILS elements and and special logistics requirements identified in the ILSP and TEMP.

Figure 10-7. ILS considerations in the full-scale development phase (cont'd).

Figure 10-8. ILS Considerations in the Production and Deployment Phase.

a. After MS III, the MATDEV updates the ILSP and the production contractors statement of work to ensure all supportability deficiencies are corrected. The OEIs are revised in conjunction with the independent operational and technical evaluators to include the independent logistician and other ILS program participants as required by the changes made that may impact their activities.

b. Ensure that remaining OEIs or deficiencies associated with the logistics supportability concepts, doctrine, organization, and materiel are incorporated into the ILSP and that the TEMP is updated.

c. In the TEMP, include resources required for FOTE.

d. In the TEP, identify data sources and criteria needed to complete the logistics supportability evaluation. Address elements of the SSP that required a waiver or were not fully tested or evaluated during IOTE and any remaining issues regarding logistics supportability doctrine, concepts, or organization. If the evaluation is to be supported by SDC (AR 750-37), provide input to the SDC plan.

e. The following actions are required for tracking and reporting deficiencies:

1) Report deficiencies to the MATDEV.

2) Establish a plan for validating and verifying corrective actions.

3) Establish specific methodology to monitor status of all corrective actions.

4) Validate and Verify completed corrective actions for all logistics support deficiencies regardless of source.

5) Input OT-identified deficiencies to the ATEDB.

6) Review SDC plans to ensure follow-up data collection and reporting supports the requirement to valid and verify that logistics deficiencies are correctly in a timely cost effective manner.

Figure 10-8. ILS considerations in the production and deployment phase.

7) Use the Independent Logistician's ILSMIS and the USALEA/HQDA DCSLOG Command Logistics Review Team results as additional sources of deficiency evaluation. (OPTEC/AMSAA/HQDA DCSLOG/AMC MOU and AR11-1).

Figure 10-8. ILS considerations in the production and deployment phase (cont'd).

ILS ORGANIZATIONS

(1) The US Army Materiel Systems Analysis Activity (AMSAA), Army Materiel Command(AMC). AMSAA is the Army's designated "Independent Logistician" responsible to Department of the Army Deputy Chief of Staff for Logisitics for performing the ILS program surveillance, independent logisitics supportability assessments, and evaluations on all materiel acquisition programs and deployed systems with the exception of medical items for which the U.S. Army Medical Materiel Agency is responsible. AMSAA will use data from both technical and operational testing and include any other testing as input to its supportability assessments.

(2) Test and Evaluation Command and Army Materiel Systems Analysis Activity. TECOM and AMSAA are responsible for Technical T&E of the ILS elements. This T&E provides for the operational tester a safe and usable system to conduct a satisfactory user test. All ILS elements receive a technical verification and certification that the system meets the specifications used by the contractor to develop the system.

(3) Combined Arms Support Command (CASCOM) develops tactical logistics doctrine, concepts, organizations, and materiel for all organic levels of maintenance excepting Depot Level which is the responsibility of AMC. LOGCEN and AMC work in close coordination to insure the planned depot level maintenance will provide the necessary support for the other organic support units.

(4) Combat Developer. This is the organization element, normally the TRADOC schools and centers, that develop the MNS and ORD that serve as the basis for any new materiel system. The logistics supportability required is generally described in both the MNS & ORD through close coordination with the designated Independent Logistician (AMSAA). It is important that logistics supportability be reviewed carefully as early as possible in the acquisition cycle because O&S costs normally make up a very large percentage of the total program costs. Failure to establish the proper logistics procedures and parameters at program initiation will result in higher support costs and impact both technical and operational testing. The combat developer also is responsible for the establishment of the institutional training processes necessary to train both operators and maintainers.

Figure 10-9. ILS Organizations.

(5) Materiel Developer. This is the organizational element that converts the combat developer's requirements into a specification that is furnished to the industrial base for contractors to compete against to develop a system that will fulfill the user's needs. The Materiel Developer establishes a statement of work for the ILS elements using the logistics concepts established by the MNS and the ORD. It is critical for both the technical and operational tester to participate with the Materiel Developer during the processes leading to releasing of the ILS statement of work to the respective contractors. This will ensure adequate testing of supportability is contained is all test plans.

(6) OPTEC. Tester and evaluator, with the influence and guidance of the OPTEC ILS Division, measures the suitability of the supportability concept agreed to by the CBTDEV. This concept is translated into a COIC followed by AOICs.

Figure 10-9. ILS Organizations (cont'd).

Figure 10-10. Example of a time-line analysis of administrative and logistics downtime.

Supply support

PLL/ASL

Demand For Item(s)
Task Requiring Item(s)
Identification of Item(s) [FGC, LCN]
Serviceability Code of Item(s)
Direct Exchange of Item(s)
Quantity of Item(s) Required
Date and Time of Requisition of Item(s)
Operating Units on Item(s)
Disposition of Replaced Item(s)
Administrative and Logistics Downtime
Item on PLL/ASL Listing
Level of Maintenance Requiring Item(s)
Common or System Peculiar Identification
Mission Criticality

Figure 10-10. Example of a time-line analysis of administrative and logistics downtime.

Figure 10-11. Data requirements for logistics elements.

POL

POL Demand by System or Support Vehicle
Quantity of POL Required
Source of POL

Location of POL
Administrative and Logistics Downtime

Other

Demand For Bulk Items
Demand for On Board Spares
Demand for Basic Issue Item(s)
Demand for Additional Authorized List (AAL) Item(s)
Task Requiring Item(s)
Quantity of Item(s) Required
Location of Item(s)
Administrative and Logistics Downtime

Manpower and personnel

Operator and crew

Identification Of Task
Critical and Non-critical Task
Clock Hours by MOS
Results of Action
Identification of MOS
Operation, Maintenance, and Support Personnel Required
Man Hours by MOS

Supply Support Personnel

Task Requiring Supply or Support Personnel
Result of Action
Man Hours for Task by MOS
Administrative And Logistics Downtime
Critical and Non-critical Tasks
MOS of Supply and Support Personnel
Number of Supply and Support Personnel Required
Man Hours by MOS

Maintenance Personnel

Figure 10-11. Data requirements for logistics elements.

Task Requiring Maintenance Personnel
Level(s) of Maintenance for Task
Man Hours by MOS
Clock Hours by MOS
Critical and Non Critical Task for Each MOS

Set Up Time by MOS for Each Task
Clean Up Time by MOS for Each Task
Calibration Team Required for Task
Supply Support Required for Each Task
Results of Action
Administrative and Logistics Downtime
MOS of Maintenance Personnel
Level(s) of Maintenance for Task In Manual
Number by MOS Maintenance Personnel Required
Diagnostic Time by MOS for Each Task
Contact Team Required for Each Task
TMDE Required for Task
On and Off Repair
Time For Task in Manual (Maintenance Allocation Chart (MAC))

TMDE

Test program sets

Demand for TPS
Identification of TPS
Identification of ATE Using TPS
Location of TPS
TPS Setup Time
TPS Diagnostic Time (Isolation, Location)
Task Requiring TPS
Administrative and Logistics Downtime
Maintenance Level Requiring TPS
MOS Using TPS
TPS Initialization Time
TPS Utilization Units
Result of TPS Action

BITE

Fault Indication
Fault Isolated Correctly
Used in Maintenance

Figure 10-11. Data requirements for logistics elements (cont'd).

Fault Detected Correctly
False Alarm
Type of BITE

Manual test equipment and ATE

Demand for ATE
Identification of ATE
ATE Setup Time
ATE Diagnostic Time
Maintenance Level Requiring ATE
Time to failure of ATE
Time to Calibrate ATE
MOS Repairing and Calibrating ATE

Administrative and Logistics Downtime
Common or Special Purpose
Task Requiring ATE
Utilization Units of ATE
ATE of Initialization Time
MOS Operating ATE
Quantity of ATE Required
Time to Repair ATE
Demand for ATE Calibration
Results of ATE Action
ATE Documentation Required

Tools, tool kits, and other maintenance equipment

Demand for Item(s)
Identification of Item(s)
MOS Requiring Item(s)
Utilization Units of Item
Level of Maintenance Requiring Item(s)
Maintenance Clock Hours Used
Task Requiring Item
Location of Item(s)
Identification as Common or Special Purpose Quantity Required
Administrative and Logistics Downtime
Technical documentation

Manuals

Demand for Manual(s)
Task Requiring Manual(s)
Identification of Manual(s)
Location of Manual(s)

Figure 10-11. Data requirements for logistics elements (cont'd).

Level of Maintenance Using Manual(s)
MOS Using Manual(s)
Manual(s) Procedure(s) Used
Error(s) in Manual(s)
Result of Manual Use
Administrative and Logistics Downtime

Calibration

Demand for Calibration
Identification of Calibration Documentation
Location of Documentation
Result of Calibration
Tasks Requiring Calibration
Calibration Procedure(s) Used
Item Requiring Calibration
MOS Calibrating System
Administrative and Logistics Downtime

Other

Demand for Other Technical Documentation
Other Documentation Procedures Used
MOS Using Other Documentation
Level of Maintenance Using Manual(s)
Task Requiring Other Documentation
Identification of Other Documentation
Location of Other Documentation
Result of Other Documentation Use
Administrative and Logistics Downtime

Other support equipment

Demand for Support Item(s)
Identification of Support Item(s)
MOS Operating or Using Support Item(s)
Quantity of Support Item(s) Required
Results of Action
Administration and Logistics Downtime
Common or special-purpose
Task Requiring Support Item(s)
Location of Support Item(s)
Utilization Units of Support Item(s)
Level of Maintenance Requiring Support Item(s)
Compatibility of Support-Item(s)

Figure 10-11. Data requirements for logistics elements (cont'd).

Figure 10-12. Example of a logistics burden analysis for fuel consumption.

1. POL consumption rate per system = 10 gallons per hour (test).
2. Mission length = 24 hours per day (OMS/MP).
3. Number of generators in unit = 20 (BOIP).
4. Requirement = 5 gallons per hour per system (ROC).
5. Fuel tanker capacity = 600 gallons (TOE and tanker description).
6. Unit demand analysis.
a. 10 gallons per hour X 24 hours per day = 240 gallons per day per system.
b. 240 gallons per day per system X 20 systems = 4800 gallons per day per unit.
c. 4800 gallons per day per unit/600 gallons per tanker = 8 tanker loads per day.
d. Requirement was for four tanker loads per day. Further analysis is required.
e. Tanker turnaround time = 4 hours (test).
f. Number of units supported = 10 (O&O Plan).
g. Storage bladder capacity = 10,000 gallons (TOE).
h. Manpower per tanker = 4 operators per truck; 2 crews per 24 hours (TOE).

7. Number of tankers required .
a. 8 tanker loads per day X 10 units supported = 80 tanker loads per day.
b. Demand = 24 hours per day/4-hour turnaround time per tanker = 6 tanker loads per tanker per day.
c. 80 tanker loads per day required/6 tanker loads per tanker per day = 13.3 tankers required.
d. 13.3 tankers required X 1.2 operational availability factor (.2 is the additional requirement because of .80 availability) = 16 tankers required in unit (3 are DX supply items in unit).

8. Number of bladders required.
a. 4,800 gallons per day per unit X 10 units = 48,000 gallons per day.
b. 48,000 gallon per day per unit supplied x 20-day supply required = 960,000 gallons storage required.
c. 960,000 gallons storage required/10,000-gallon bladder capacity = 96 bladders required.

9. Manpower required.
a. 13 tankers in operation X 4 operators per tanker = 52 tanker personnel in operation.

Figure 10-12. Example of a logistics burden analysis for fuel consumption.

b. 96 storage bladders/10 bladders per 3 personnel X 3 personnel = 29 personnel in bladder operations.
c. Total manpower = 81 persons required.
10. The additional resources required are--
a. 8 tankers.
b. 48 bladders.
c. 40 personnel.

Figure 10-12. Example of a logistics burden analysis for fuel consumption (cont'd).

Note: If these resources are not added, only half the total fleet will be maintained committable with fuel or will be able to operate 12 of the 24 hours required. Although Ao does not include measurements of fuel availability, this lack of fuel carries the same impact on Ao as maintenance. Because only 50 percent of the fuel reserves will be available, the Ao for this generator is, in effect, 50 percent even before maintenance is considered. The logistics burden associated with this required increase must be identified. In this fuel consumption analysis example, the requirement for twice the fuel translates into double the programmed tankers, bladders, and manpower support at the resupply point. Without redesign or adding these needed assets, a 50 percent reduction in operational readiness will result.

1. Requirement = move ASL in one move (O&O plan).

2. ASL current volume capacity = 10,000 cubic feet (TOE and supply van description).

3. Additional capacity required = 2,800 cubic feet (LD and test).

4. Additional capacity planned = 1,000 cubic feet (BOIP and supply van description).

5. Shortfall = 1,800 cubic feet.

6. The ASL will require two moves or additional supply vans to transport the ASL.

Figure 10-13. Example of a logistics burden analysis for authorized stockage list volume.

1. Density = 6,000 items (BOIP).

2. Mission length = 12 hours (MP).

3. Usage rate = 2,400 hours per year (OMS).

4. Reliability requirement = 500 MTBF (ROC) = 4.8 failures per year

5. Manhours per repair = 2.0 hours (test)

6. Reliability estimate = 175 MTBF (test) = 13.7 failures per year.

7. Increase in failures per year = 8.9.

8. Additional failures per year = 6,000 items X 8.9 failures = 53,400 failures per year.

9. 53,400 failures per year x 2.0 manhours per failure = 166,400 manhours per year.

10. One manyear = 4,456 manhours = 37 additional repairmen.

Note: Further analysis could be performed to determine the level(s) of maintenance and MOS at which the shortage occurred. In addition, this shortfall may indicate the need for additional tools, TMDE, or vehicles. Because the reliability requirement is not met, the reliability degradation translates into approximately three times as many failures as projected. Accordingly, if no reliability improvement is obtained, 43 more maintenance personnel will be required to support the system.

Figure 10-14. Example of a Logistics Burden Analysis for Maintenance Manpower.

1. Density = 6,000 items (BOIP).

2. Mission length = 12 hours (MP).

3. Usage rate = 2,400 hours per year (OMS).

4. Reliability requirement = 500 MTBF (ROC) = 4.8 failures per year

5. Manhours per repair = 2.0 hours (test)

6. Reliability estimate = 175 MTBF (test) = 13.7 failures per year.

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Note: Further analysis could be performed to determine the level(s) of maintenance and MOS at which the shortage occurred. In addition, this shortfall may indicate the need for additional tools, TMDE, or vehicles. Because the reliability requirement is not met, the reliability degradation translates into approximately three times as many failures as projected. Accordingly, if no reliability improvement is obtained, 43 more maintenance personnel will be required to support the system.

Figure 10-15. Example of a Logistics Burden Analysis for Maintenance Manpower.

1. Number of systems to be supported in the unit = 200 (TOE).
2. Number of systems supported in test = 4 (test).
3. Daily utilization per day = 2 hrs per day (test).
4. Ao for the system = .90 (test).
5. Ao for TMDE = .80 (test).
6. Number of TMDE in test = 1 (test).
7. Number of TMDE planned for unit = 4 (TOE).
8. Average utilization per system:
a. 2 hrs per day/4 systems tested = .50 hrs/day per system.
b. 200 systems in unit X .90 availability = 180 systems operational per day per unit.
c. 180 systems operational X .50 hrs per day per system @ 90 hrs per day TMDE utilization.
9. TMDE required:
a. 24 hrs per day X .80 TMDE availability = 19.2 hrs operation available per day.
b. 90 hrs per day TMDE utilization/19.2 hrs available per day = 4.7 TMDE items required.
10. Impact of fielding with 4 TMDE: without combat losses being considered, 4 TMDE can support the following number of systems:
a. 4 TMDE authorized X .80 Ao = 3.2 TMDE available.
b. 3.2 TMDE available X 24 hrs per day = 76.8 hrs operation per day.
c. 76.8 hrs operation per day/.50 hrs TMDE demand per day per system = 153.6 systems supported.
d. With 180 systems operational per day, a backlog of systems will develop at the TMDE stations because only an average of 3.2 TMDE items are operationai at any time. System Ao will be degraded.
e. Considering combat losses:
(1) Expected percent lost per day = .20.
(2) Therefore at the end of the first combat day, 180 systems X .80 = 144 systems plus 20 in maintenance = 164 systems in fleet for second day with 147 available (164 X .90).

Note: After the first day of battle, the TMDE will be able to support the unit. Consequently, 4 TMDE may be acceptable. The TMDE analysis example demonstrates how the logistics burden is affected by the difference between the force slice tested and the force slice to be supported. Although no problem with queuing at the TMDE was observed in test, considering the force slice to be fielded shows that a queuing problem will result. The analysis also suggests how consideration of combat losses can affect the analysis conclusions; although analysis may show at first that the queuing problem, the a location of TMDE may prove correct when combat losses are considered. Expected system losses in the first 3 days of battle could overcome the queuing problem.

Figure 10-16. Example of a logistics burden analysis for test measurement and diagnostic equipment.

1. Tool utilization = 40 maintenance clockhours per month per system (OT).

2. Number of systems in unit = 60 (BOIP).

3. Number of tools allocated to unit = 4 tools (BOIP).

4. Required tool hours = 40 X 60 = 2,400 maintenance clockhours per month.

5. Available hours = 720 hours per month X 4 tools = 2,800 hours.

6. A sufficient number of tools has been provided.

Figure 10-17. Example of a logistics burden analysis for tools.

1. Number of critical operator tasks validated by military operators = 42 (OT).

2. Total critical operator tasks technically validated in operator's manual = 210 (review of manual and TT).

3. Percent critical operator tasks demonstrated as correct by military operators = 42/210 = 20 percent.

4. Therefore, 80 percent of validated critical operator tasks have not been demonstrated by military operators.

Figure 10-18. Example of a logistics burden analysis for technical documentation.

1. Estimated LRU cost = $50,000 (contractor engineering estimate in current dollars).
2. Estimated cost to repair LRU = $1,500 (comptroller data in current dollars).
3. Operating time = 6,000 hours (test).
4. Number of LRU failures = 6 (test).
5. System operating time per year = 4,000 hours (OMS/MP).
6. Expected number of failures per year per system = 4.
7. Number of systems to be fielded = 1,000 (BOIP).
8. Percent of LRU repaired = .66 (test).
9. Percent LRU replaced = .33 (test).
10. 4 failures per year per system X 1000 systems = 4,000 failures per year.
11. 4,000 failures X .66 = 2,640 repaired per year.
12. 4,000 failures X .33 = 1,320 replaced.
13. 2,640 failures X $1,500 . $3,960,000 for repair.
14. 1,320 failures X $50,000 = $66,000,000 for replacement.
15. Total cost per year for repair and replacement = $69,960,000.

Figure 10-19. Example of a logistics cost analysis.

DATA SOURCES	DO THE SYSTEM AND UNIT, WHEN SUPPORTED IN ACCORDANCE WITH THE APPROVED LOGISTICS DOCTRINE, CONCEPTS, MATERIEL, AND ORGANIZATION, ACHIEVE THE REQUIRED READINESS?	WHAT ARE THE LOGISTIC SUPPORTABILITY BURDENS ASSOCIATED WITH THE SYSTEM?							WHAT ARE THE LOGISTIC SUPPORTABILITY COSTS ASSOCIATED WITH THE SYSTEM?	WHAT DEFICIENCIES IN THE SYSTEM SUPPORT PACKAGE ARE IDENTIFIED DURING THE TEST?
		SUPPLY SUPPORT	MANPOWER AND PERSONNEL	TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT	TOOLS/TOOL KITS AND OTHER MAINTENANCE EQUIPMENT	OTHER SUPPORT EQUIPMENT	TECHNICAL DOCUMENTATION	TRAINING		
1. CONTRACTOR TEST				X	X					
2. FORCE DEVELOPMENT TEST AND EXPERIMENTATION	X		X							
3. LOGISTICS OR MAINTENANCE DEMONSTRATION				X	X		X	X		X
4. TECHNICAL TEST	X	X		X	X	X	X			X
5. OPERATIONAL TEST	X	X	X	X	X	X	X	X		X
6. UNIT LEVEL LOGISTICS MODELS	X	X	X	X	X	X	X	X	X	X
7. SAMPLE DATA COLLECTION		X								
8. TECHNICAL AND OPERATIONAL TEST TRAINING				X	X	X	X	X		

Figure 10-20. Logistics supportability operational issues and data source matrix.

Deputy test director (DTD) for logistics.

Substantial efforts are required for all systems to assure the planned logistics support is effective because adequate logistics/sustainability is always a critical issue. A DTD for logistics is included in the OTP resources for the OT. The DTD for logistics, who is familiar with the Army's logistics support system, doctrine, organization, and concepts, has the following functions:

a. Assisting in preparing the Detailed Test Plan (DTP).

b. Collecting logistics supportability data.

c. Controlling the SSP.

d. Assuring realism in the play of the SSP.

e. Controlling play of logistics support doctrine, organization, and concepts in test.

f. Determining when contractor support will be played.

g. Determining that the repair parts and spares are tracked, utilized correctly, and disposed of within the logistics support concept stated for the system.

h. Determining the validity of the maintenance and logistic data bases.

i. Determining the requirement for post test maintenance and support exercises.

Figure 10-21. Deputy test director for logistics.

Table 10-1. Examples of measures of performance and baseline criteria for selected logistics supportability elements

Measure of performance	Description	Baseline criterion (%)
Supply support		
Demand satisfaction index	Percent of valid system-unique and mission-critical supply requests satisfied from the PLL/ASL (i.e., the item is in stock)	80
Demand accommodation index	Percent of valid system-unique and mission-critical supply requests accommodated from the PLL/ASL (i.e., the item is normally stocked)	80
Mobility index	Percent of PLL/ASL lines that are transportable in a single move.	100[1]
Volume accommodation index	Percent of required supply support space and volume that can be accommodated with planned storage facilities	100
POL index	Ratio of the POL replenishment rate to the POL consumption or delivery rate	100
Zero balance index	Percent of zero balance PLL/ASL lines	10
Repairable exchange index	Percent of valid repairable exchange requests filled	80
PLL/ASL line item increase index	Percent of new PLL/ASL line items	10

Table 10-1. Examples of measures of performance and baseline criteria for selected logistics supportability elements.

Measures of performance and baseline criteria for selected logistics supportability elements-Continued

Measure of performance	Description	Baseline criterion (%)

Logistic reliability measures

Mean time between removals, cost per repair, and others[2]

Consumption and replenishment rates

Rates at which supply support is consumed and replenished[3]

Tools, tool kits, and other maintenance equipment

Tool index
Percent increase in required common or special tools or tool kits
0.0

Tool utilization rate
Percent of common or special tools or tool kits utilized
None

Tool hour utilization rate
Ratio of tool utilization hours to the total number of maintenance clock hours during the same time period
None

Technical documentation

Percent critical tasks or procedures validated
Ratio of the total number of tasks or procedures in the manual to the number validated
100[4]

Percent of erroneous procedures or tasks
Ratio of erroneous tasks and procedures in the manual demonstrated to the total tasks and procedures demonstrated
0[5]

MAC times
Percent of MAC times demonstrated by the soldier to total number of MAC times in the manual
100[4]

Table 10-1. Examples of measures of performance and baseline criteria for selected logistics supportability elements (cont'd).

Percent of NSNs assigned in parts manual Percentage of parts that have been assigned NSNs 100[4] Notes: 1. If mobility of the PLL/ASL is critical to the system. 2. There are no baseline criteria, but criteria can be obtained for individual systems from the ORD, from historical data of similar systems, or from the LSAR. 3. There is no baseline criterion, although there may be requirements in the ORD or historical data and cost estimates on similar systems. 4. The ratio should approach 100 percent as the system nears the production decision. 5. The ratio should approach 0.0 percent as the system matures.

Table 10-1. Measures of Performance and Baseline Criteria for Selected Logistics Supportability Elements.

Chapter 11
Test and Evaluation of Reliability, Availability and Maintainability (RAM)

Section I
RAM in the Materiel Acquisition Process

11-1. General

a. This chapter defines the RAM related activities of T&E throughout the life cycle of a materiel system. It discusses the development tester and evaluator/assessor (covered by the umbrella term "evaluator") and the operational tester and evaluator roles regarding RAM in the combat and materiel developments process, T&E planning, T&E conduct, and T&E assessment.

b. The material in this chapter is to be tailored for each program based on the level of complexity of the system, the acquisition phase, acquisition strategy, and the impact of RAM on the performance and suitability of the system. As presented, it illustrates comprehensive application to the most complex systems, but is intended for selective application as appropriate. Army RAM policy is established in AR 702-3.

11-2. Reliability

Table 11-1 provides the classic definition of reliability and defines the two general types of reliability which need to be addressed in operational evaluation. Mission reliability addresses the system effectiveness, while logistics oriented reliability addresses the burden of owning and operating the system.

(Insert TABLE 11-1)

a. The development of a reliability requirement usually assumes that the failure rate of the mature system will be constant over a long period. This assumption allows the requirement to be expressed, not as a probability, but as an easily measurable parameter directly related to reliability.

b. In test and evaluation the mission reliability parameter is normally one of the following:

(1) Mean Time Between Operational Mission Failures (MTBOMF).

(2) Mean Time Between Failures (MTBF).

(3) Mean Time Between Mission Aborts (MTBMA).

(4) Mean Time Between Mission Affecting Failures (MTBMAF).

c. If the system has another measure of usage besides time, then the parameter is expressed with those units such as miles, rounds, or events between failures. For single shot devices, such as a missile system, reliability is expressed as a ratio of the number of successes to the number of total attempts.

11-3. Maintainability

Maintainability relates to the ease and efficiency of performing both corrective and scheduled maintenance on a system. Table 11-2 defines maintainability and the two most common parameters used in maintainability assessment.

(Insert TABLE 11-2)

11-4. Availability

Availability is used to assess systems which spend a portion of their time in a ready status and at some undetermined time are required to initiate a mission. A system's availability is a function of its reliability and maintainability. Table 11-3 provides the definitions of availability and operational availability.

(Insert TABLE 11-3)

11-5. Operational Versus Technical RAM

The concept of operational RAM differs significantly from technical RAM.

a. Technical RAM examines the RAM characteristics based only on the hardware and embedded software of the system. It focuses on the extent to which the system meets technical RAM specifications and reflects those failures for which the system contractor is accountable.

b. Operational RAM considerations for a system relate to its hardware, embedded software, typical operators and maintainers, manuals, tools, Test, Measurement, and Diagnostic Equipment (TMDE), support equipment, and the operational, organizational, and logistical support concepts. Operational RAM quantifies the degree to which the user can rely on required system functions and the burden associated with keeping those functions at his disposal. The operational RAM assessment cannot be disassociated from the operational scenarios in which the system must function nor from the support environment on which the system must rely.

Section II
RAM Overview

11-6. Overview of RAM in the Life Cycle

a. Operational RAM values expressed in requirements documents will be developed in coordination with the development and operational independent evaluators (See AR 702-3).

b. Development and operational testing will be oriented toward providing data with which to estimate the operational RAM values expressed in the requirements document. Tests will be designed to ensure that statistically adequate estimates of developmental and operational RAM values are provided. See Part Four for RAM in DT.

c. Testing at the system level will be conducted in accordance with the operational mode summary and mission profile (OMS/MP). This testing will be designed to reflect, as closely as possible, field usage to contribute consistency to testing and to facilitate data combination.

d. Data from testing will be scored, assessed, and aggregated in accordance with the provisions of AR 702-3.

e. Test planning will be a joint effort oriented toward maximizing planned statistical combination of RAM data. The test program will be structured so that subtests, taken as a whole, will provide a statistically sufficient sample size to address the RAM requirements.

f. Estimates of the operational RAM values resulting from the RAM assessment conference will be presented by the operational evaluator to the milestone decision review body (See AR 702-3). The operational evaluator may also present independent estimates of the operational RAM values based on selected RAM data, appropriate analytical techniques, and projected and/or expected modifications to the operational employment of the system in a field environment.

g. The development evaluator will present to the pre-ASARC or MAISRC or IPR estimates of the RAM values based on selected RAM data, appropriate analytical techniques, and projected engineering or utilization changes to be made in the system.

h. When final development and operational testing RAM values differ, the evaluators will advise the milestone decision review body of the probable cause. Such differences will be rationalized by the review body.

i. At program reviews, program managers will indicate how their programs are structured to attain the RAM requirements and will (where appropriate) present growth curves that provide a realistic portrayal of how the system RAM will grow to the desired performance requirements. All growth curves will have development independent evaluation coordination and will be provided to the operational independent evaluator.

j. The contract RAM requirements and test procedures will be coordinated with the development independent evaluator and provided to the operational independent evaluator and combat developer for information. This requirement will be accomplished through coordination of the request for proposal (RFP), or equivalent contract solicitation document, before its release.

k. Scoring and assessment of the contractor data will be accomplished in accordance with the procedures of AR 702-3 and Sections III and V, below.

l. The independent evaluator is responsible for analyzing system RAM characteristics, and evaluating RAM characteristics and performance. This requires selective participation in acquisition events, input to selected planning documents, and development of a plan to quantify system RAM characteristics in terms of mission objectives. This plan requires the evaluator's understanding of and input to the definitions of the operating and support environments, the operational tasks required of the system, acceptable levels of task performance, and the relationship of tasks to mission objectives.

m. Figure 11-1 outlines the RAM process as it relates to test and evaluation. The following paragraphs define the independent evaluator's level of participation in, contribution to, and expectations from the outlined events.

(Insert Figure 11-1)

11-7. RAM Program Plan (AR 702-3, MIL-STD-470, MIL-STD 785)

a. Early in the concept exploration phase the MATDEV or program managers office prepares the RAM Program Plan. The RAM Program Plan may be a single document or it may be a series of plans, one for reliability (MIL-STD-785), one for maintainability

(MIL-STD-470) and so on. The plan (or set of plans) defines both the contractor and government RAM programs. The RAM Program Plan is developed in coordination with the development evaluator and is available through the program manager to the operational evaluator, logistician, and the CBTDEV for comment.

b. The RAM Program Plan includes:

(1) Identification of and schedule for the program tasks to be performed in order to meet requirements along with a detailed description of how each task will be performed or complied with.

(2) The procedures to evaluate the status and control of each task and identification of the organization with authority and responsibility for executing each task.

(3) Interrelationships of RAM tasks with other system oriented tasks.

(4) Known RAM problems to be solved; their anticipated impact on the system's capability to meet the requirements and the plan to solve the problems.

(5) RAM milestones.

(6) Identification of key personnel and management structure for the RAM program.

c. The RAM Program Plan lays out the overall plan to meet RAM requirements early in the development process and offers the opportunity for the independent operational evaluator to make an early impact on this planning. The operational evaluator reviews the tasks, schedules and milestones as part of his effort to develop an effective evaluation strategy complementary to the acquisition strategy. The operational evaluator also reviews any identified RAM problem areas and initiates plans to monitor their resolution.

11-8. RAM Rationale Report (AR 702-3, TRADOC/AMC PAM 70-11)

a. The purpose of a RAM Rationale Report is to develop and document the RAM requirements for a proposed system. The RAM Rationale Report is developed by the RAM Rationale Report Joint Working Group (RRR JWG), with the combat developer having the overall responsibility for establishing RAM requirements. The RRR JWG consists of the combat developer, the materiel developer, the independent operational evaluator and the independent development evaluator.

b. Evaluator familiarity with TRADOC/AMC Pamphlet 70-11 RAM Rationale Report Handbook, is required before participating in a RRR JWG or reviewing a RRR. The objective of the independent operational evaluator participation in the development of the RAM Rationale Report is to insure that:

(1) The Operational Mode Summary/Mission Profile (OMS/MP) adequately describes the mix of ways the system will be used in its peacetime and wartime operational roles. The mission profiles adequately identify the tasks, events, durations, operating conditions, and environment for each mission.

(2) An operational FD/SC is developed which provides for consistent categorization and classification of test incidents. It must contain clearly defined mission essential functions with acceptable levels of degradation for each function.

(3) The operational RAM requirements are based on both mission need and operating and support (O&S) cost considerations and provide a firm basis for the operational evaluation.

(4) The justification and rationale for the RAM requirements are based on methodologies and assumptions supported by the independent evaluator.

(5) An acceptable baseline and technical feasibility analysis has been done by the materiel developer.

(6) An audit trail exists from operational RAM requirements to technical requirements.

c. After the RAM Rationale Report has been approved and signed by all RRR JWG representatives, the executive overview is attached to the requirements document as the RAM appendix.

11-9. RAM in the Test and Evaluation Master Plan (DOD 5000.2M, AR 73-1)

a. The TEMP is the planning document containing both technical and operational critical issues and criteria, which include RAM. The TEMP is the document in which the length of the operational test is determined.

b. The evaluators ensure that there is sufficient test length to obtain statistically valid results. The test length is often driven by reliability considerations and there are several methods for determining the required length of test. System, dollar, and time constraints govern which method is best for a

given application.

c. Two references outline the most common procedures to determine test sample size. One is MIL-STD-781, Reliability Design Qualification and Production Acceptance Tests: Exponential Distribution. The other is DOD 3235.1-H, Test and Evaluation of System Reliability, Availability and Maintainability, A Primer. A minimum sample size of three systems each operating one and a half times over the operational reliability requirement is a general rule of thumb applied to determine the absolute minimum sample required.

d. The TIWG typically has a RAM subgroup to advise it on the existence and resolution of RAM issues involving test planning and design, test criteria, contractor testing, technical testing, operational testing, and first article/initial production testing. The subgroup is made up of representatives from the materiel developer, combat developer, and the development and operational independent evaluators. It is also augmented by others as appropriate.

e. The evaluators insure that there is adequate resolution of operational concerns such as length of test, quantity of test items or problems with the implementation of the OMS/MP and FD/SC.

11-10. RAM in Test and Evaluation Planning (AR 73-1)

a. In the IEP, TP, and TEP, the evaluator, tester, and RAM analyst plan for the T&E of system RAM and its relation to the technical requirements and the operational effectiveness and suitability of the system. The RAM technical characteristics and the RAM critical and additional operational issue(s) provide the vehicle for translating the RAM related requirements into criteria, measures of performance, and data requirements in planning.

b. Anticipated analysis plans and techniques are discussed (e.g., reliability growth, modelling, data aggregation with development testing, and methods of analytically dealing with corrective actions).

c. In OT (if warranted by the data requirements) OPTEC's automated RAM data management system OTERAM should be planned for use to provide for efficient RAM data collection, reduction and management. OTERAM also provides a proven data base structure, an automated database, and automated production of Test Incident Reports (TIRs). Figure 11-2 shows the basic OTERAM structure.

The OTERAM system is generic and requires some tailoring to accommodate the various types of systems. TECOM employs similar RAM data collection systems for DT.

d. All tests, whether an automated RAM data base is used or not, are required to develop and forward TIRs to the Army central TIR storage facility. TIR preparation methods, forms and procedures for input to the data base are contained in Chapter 17.

e. The RAM content of test design consists of refinement of the RAM data requirements, procedures for insuring that the test scenarios follow the OMS/MP, a description of the maintenance environment, initial planning for RAM data collector training, RAM data form management, data authentication, review and validation, development of TIRs, and refinement of the RAM data base (when applicable).

(Insert Figure 11-2)

11-11. RAM in the Detailed Test Plan

The Detailed Test Plan (DTP) is the document in which plans are made for the detailed control of the maintenance and logistics during the test. It is governed primarily by the System Support Package and the Doctrinal and Organizational Test Support Package. The tester RAM analyst insures that all RAM considerations with respect to data collection, data processing and data reporting have been adequately addressed.

11-12. RAM in the Conduct of Testing (AR 73-1)

a. The evaluator, tester, and their RAM analysts prepare for Test Readiness Reviews by reviewing the following RAM related areas to identify problem areas which may have a negative impact on the successful conduct of the test.

(1) Quantity of test items and schedules of delivery.

(2) Adequacy and completeness of System Support Package (SSP) to include Test Measurement and Diagnostic Equipment (TMDE), Built In Test and Built In Test Equipment (BIT/BITE), spares and repair parts, operator and maintenance technical manuals, availability of special and common tools, and required support equipment (trucks, generators, special handling equipment, etc.).

(3) Training of maintainers and operators.

(4) Data collection planning/preparation to include RAM data collection forms, RAM data collector training and availability, RAM data management and quality control, and the quantity and quality of RAM data collectors.

(5) Reduction and automation of RAM data to include RAM data base structure and programming, quality control of reduced data, planning and programming for output products, test Incident Report (TIR) preparation, and transmission of TIR to the data base.

(6) Planning and procedures for the RAM Data Authentication Group (DAG), if required.

(7) Schedule and plans for the RAM scoring and assessment conferences.

(8) Unsettled differences with the FD/SC.

(9) Estimates of RAM requirements based on previous testing, maintenance and logistics demos, and contractor testing as appropriate.

b. Serious problems or potential "show stoppers" are raised to the commander as soon as possible before the review.

c. All system components including hardware, software, ground support equipment, training, manuals, and TMDE undergo testing.

d. The system configuration should remain fixed during OT or at a minimum, corrective actions should be implemented in groups.

e. The tester RAM analyst insures that all RAM data is properly collected, reduced, authenticated and validated. The evaluator RAM analyst insures that all RAM data is appropriately reported and analyzed. The tester RAM analyst typically acts as chairman of the RAM subgroup of the DAG and evaluators or their RAM analysts chair the RAM scoring conference and the RAM assessment conference.

f. All RAM TIRs are provided to TECOM for inclusion in the Army's central TIR storage facility (see Chapter 17).

11-13. RAM in the Test and Evaluation Reporting (AR 73-1)

a. The RAM portion of the IER or TER includes (or references the data base containing) all the RAM data collected as part of the evaluation. In addition the report usually includes

estimates of the RAM parameters based on the results of the scoring or assessment conference. RAM estimates can differ from those established in the assessment conference if a audit trail and rationale are provided.

b. Clear identification is to be made of any data taken under abnormal circumstances, which for any reason is known by the test directorate to be atypical. The report also includes any test constraints or limitations which could have had an impact on the typicality or realism of the RAM data.

c. When an automated data base, such as OTERAM, is used to store RAM data from a large test, a description of the data base and its contents are provided in the report.

d. Operational RAM is a major factor in the evaluation of both operational effectiveness and suitability and is therefore focused on mission accomplishment and sustainability. Assessment of system RAM performance is made with the analysis and findings required to provide decision makers with a clear picture of:

(1) The demonstrated operational RAM estimates as compared to their requirements.

(2) The projected values at IOC and the actions required in order to meet these projections.

(3) The implications and risks of not meeting the requirements.

(4) Relevant findings indicative of ways to improve the system RAM.

11-14. RAM Test Extensions

Tests are sometimes extended for the sole purpose of collecting more RAM data in order to gain statistical confidence in meeting the requirements. If the extension requires changes from the original plan with regard to the system's operating environment, maintenance or logistics support, or data collection, this will be done through a test change proposal.

Section III
RAM Scoring Conferences

11-15. General

The procedures for scoring and assessment conferences were

developed to allow a fair determination of RAM data bases (AR 702-3). The procedures provide a disciplined set of protocols and rules for conducting RAM conferences. Any spokesperson or conference chairperson who feels the intent of this document is being misconstrued should immediately report concerns to the command focal point for RAM who will assist in resolving the problem or in soliciting resolution of the matter through appropriate command/decision authority channels.

11-16. RAM Scoring Conference Objectives

Formal scoring conferences are held during and immediately after a DT and an OT. The objectives of the scoring conferences are to establish a common test data base and to insure that a proper and consistent categorization (assigning classification and chargeability) of test incidents is made using the approved FD/SC.

11-17. RAM Scoring Conference Membership

The materiel developer, combat developer, independent operational evaluator, and independent developmental evaluator/assessor each designate a single spokesperson prior to the initial scoring conference. Whenever possible the principal spokesperson is to be the same representative who participated in developing the FD/SC. Conference voting members include the four principal RAM spokespersons.

a. Personnel representing the development tester, operational tester, and other relevant government personnel also participate as required. The logistician is invited to scoring conferences as an observer and receives copies of conference results.

b. The principal spokespersons will make up the decision making body of the scoring conference. They will perform their function within the guidelines of the this pamphlet (supplemented by agreed upon operating procedures).

11-18. Scoring Conference Chair

The chair is the materiel developer for DT conferences and the operational evaluator for OT conferences and assessment conferences. The chair may be the voting member or the chairing command may provide a dedicated chairperson. The chair is responsible for maintaining order and allowing reasonable participation by all government participants to include voting members and observers. The chair will schedule all scoring conferences and be responsible for the following:

a. Administrative functions, including preparing and distributing conference minutes.

b. Ensuring that the conference is conducted effectively and efficiently.

c. Carrying out the procedures established by guidance documents (supplemented where necessary by consensus agreements of the principal spokespersons).

d. Ensuring system contractor personnel do not attend or directly participate in RAM Scoring Conferences which address data intended to support evaluation/assessment of their system's operational RAM parameters.

11-19. Pretest Meeting
The principal spokespersons should convene prior to all DT or OT or at the first official scoring conference of a given test phase. The meeting is usually chaired by the scoring conference chair. The four principal spokespersons and the developmental and operational testers will constitute the minimum essential membership of the pretest meeting. The pretest meeting will be conducted to:

a. Review and establish a common understanding of system requirements and the failure definition and scoring criteria (FD/SC), explanation of terms, and factors used in calculating the RAM estimates (examples are item life units and repair and logistic time).

b. Establish the minimum essential data requirements for applying the approved FD/SC and developing estimates of RAM parameters.

c. Identify the parent organizations of the principal spokespersons.

d. Establish system specific procedures for the conduct of scoring conferences (such as how incidents will be discussed, any limitations or restrictions on discussion, and who may participate in the discussion).

e. Establish procedures for the corrective action process; these procedures must include the criteria for evaluating the effectiveness of corrective action.

11-20. Incident Classification and Chargeability

a. The conference consists of an organized discussion of each of the test incidents, its surrounding circumstances, cause (when

known), impact on the operational scenario, maintenance actions, hardware/software conditions, etc. Based on the FD/SC, decisions are made by each principal spokesperson as to the classification and chargeability of each incident.

b. All decisions are to be made in accordance with previously established guidelines for operation. All decisions will be by majority vote of the principal spokespersons unless there is no majority opinion regarding the classification and chargeability of the incident. The developmental evaluator/assessor will make the final scoring determination (tie-breaking vote) during scoring conferences for DT, contractor test, and production phase testing. The operational evaluator will make the final scoring determination (tie-breaking vote) during scoring conferences for OT and other user tests.

c. Minority opinions are written (by the dissenter) justifying dissenting votes and are included in the scoring conference minutes.

d. To facilitate the conference, the tester often provides the initial categorization or prescore for each test incident.

e. All test incidents are scored in a two step process using the approved FD/SC. The first step is to classify a test incident into categories, e.g. mission affecting failure, type of maintenance action, and non-RAM. In the second step the incident is charged to the underlying cause of the incident.

f. Scoring decisions consider the Design Reference Mission Profile (DRMP) for the system. The DRMP is a predetermined composite mission profile which considers the function(s) and operating environment of a system. It is based on the OMS/MP for the system. It provides a consistent basis for system design and test, and provides for consistency among tests used to estimate the RAM parameters.

g. An incident may be left unscored or tabled only if the majority of the principal spokespersons feel that additional data regarding the incident is necessary to support the incident classification and chargeability decision.

h. Incidents previously scored may be reopened if a principal spokesperson can establish that additional data on the incident has been gathered, and the chairperson or a majority of the spokespersons agree to return to that incident. Even if the incident is not reopened, the additional data may be entered into the minutes of the meeting.

i. Participation by any observers will be through or at the request of the chairperson or one of the principal spokespersons. Qbservers should not be "gagged" merely to expedite the pace of the conference. It is the responsibility of the chair to assure that all spokespersons and observers with information or value to add to the proceedings can be heard.

j. Scoring conferences should be conducted by telephone or correspondence, if feasible, particularly when only a few incidents are to be considered. A face-to-face conference will be held at the request of chairman or any of the principal spokespersons.

k. Scoring conferences will be scheduled to accommodate the principal spokespersons; a conference requires at least three principal spokespersons. If one of the principal spokespersons elects not to attend, the other three spokespersons will conduct the conference as a three-member deliberation with majority rule by the spokespersons on all actions. The absent member will recognize the scoring conference results.

l. More details on scoring conference procedures are contained in AR 702-3.

11-21. Designation of Responsibility for Corrective Action

As part of the evaluation of test incidents, the scoring conference will designate responsibility for investigating the incident, initiating corrective action as necessary, and reporting results. Activities normally responsible for corrective action include:

a. The materiel developer for contractor and government furnished equipment (CFE and GFE), including CFE and GFE hardware and software.

b. The tester for test conditions not representative of the field environment.

c. The combat developer for training and operational concepts.

11-22. Changes to FD/SC

The spokespersons cannot make any changes to the approved FD/SC which modify the mission essential functions or RAM parameters. Any changes to the FD/SC affecting these functions and parameters must be formally coordinated and approved through the RAM Rationale Report approval process, and provided to the testers and Army logistician. If such changes are made after start of test, all incidents are scored according to the revised FD/SC to

assess the effect of the change.

11-23. Distribution of Test RAM Data
The appropriate test activity will distribute incident reports and necessary maintenance data for all incidents to be scored at a scoring conference. These data will be distributed at least two weeks before the conference (or as agreed upon at the pretest meeting). If the data is unverified or incomplete, the test activity will present to the scoring conference any changes to, or amplification of, the data.

11-24. Review of Test RAM Data
For efficiency at the scoring conference, each principal spokesperson will, prior to the conference, review the initial scoring determination for each incident and identify areas of disagreement. If any spokesperson has not received the test data, the scoring conference will be delayed until each spokesperson has had sufficient time to review the data.

11-25. Contractor Participation in Scoring Conferences
The following is Army policy regarding system contractor participation in test and evaluation activities:

a. Contractors for the tested system are not allowed at any scoring conference in which RAM incidents to be scored will be used in any assessment of operational RAM parameters which may support a full rate production decision.

b. Discussions with system contractor personnel may be necessary to ensure full technical understanding of test incidents; however, discussions with system contractor personnel will be held separately from the scoring conference. A formal written record will be kept by the project manager of all separate government/contractor discussions of test incidents to include issues, contractor positions, casual analysis, and other pertinent data.

c. If the materiel developer spokesperson needs access to contractor expertise during the conference, the chair may, at his discretion, recess the scoring conference to permit materiel developer consultation with the contractor. The chair may, subject to the dissent of any spokesperson, allow the materiel developer to provide a contractor technical presentation on a pertinent aspect of the system to the conference members during the recess. Conference members may question the contractor representatives on the what, where, how, and why of the incident, but may not discuss any proposed scoring with the contractor present.

d. DT is also conducted to achieve RAM-Durability (RAM-D) maturity and, as such, can only occur if the testing is designed to find, analyze, fix, and verify problems through testing in a timely manner. These factors suggest that engineering level discussions with system contractor personnel are both encouraged and required. These discussions should, in general, take place prior to or during the conference; however, contractor personnel should NOT be physically present during the formal government discussion and voting periods.

e. In developmental test programs where it is known that testing will be conducted under conditions (OMS/MP, stresses, environmental conditions, test support, and system configuration) similar to OT, and an operational test is to be conducted during the same phase, OPTEC will notify the materiel developer that the developmental test results are to be combined with OT results. If agreed to by the materiel developer, system contractor participation in the DT scoring conferences will be the same as for OT scoring conferences.

11-26. Scoring Conference Results

The chairman will publish minutes of each scoring conference giving results of scoring and RAM calculations based on incidents scored and usage to date. These preliminary assessments, based on individual scoring conference results, must be accompanied by a statement indicating that formal evaluation is still underway, and that the preliminary values presented are not the final or official assessment of RAM performance.

11-27. Final Test Data Base

At the final scoring conferences that address data to be used for a decision, information concerning any previously scored test results will be reviewed by the conference. A final test data base identifying test length and test incidents will be established.

Section IV
Corrective Action for RAM Incidents

11-28. Corrective Action Efforts (AR 702-3)

Each activity will initiate appropriate corrective action on chargeable failures and provide a detailed analysis of these incidents. The materiel developer will take the lead in the analysis of failure incidents, and will sponsor corrective action reviews, as appropriate. Corrective actions will not be considered in the initial classification of incidents.

Corrective actions can only be considered when establishing the final test data base.

11-29. Corrective Action Process
The corrective action process will be used to eliminate or reduce RAM failure modes identified during a test.

a. This process begins at the scoring conference or in cases of critical incidents at the time of the incident. A critical incident is one which may cause severe injury, severe occupational illness, death, or major system damage.

b. As part of the evaluation of test events, the scoring conference designates responsibility for investigating the incident, initiating corrective action, and reporting the results. Activities responsible for corrective action include the materiel developer for hardware, software, TMDE, support equipment and manuals, the tester for failures caused by improper test conditions, and the combat developer for failures related to training and operational concepts.

c. Each activity initiates appropriate corrective actions and provides a detailed analysis of these incidents to the members of the scoring conference. The materiel developer takes the lead in the analysis of failure incidents, and sponsors corrective action reviews as appropriate.

d. The status of corrective actions will be provided to the scoring conference spokespersons and the Army logistician. Corrective actions may then be considered during the RAM Assessment Conference.

11-30. Evaluation of Corrective Actions
Five steps will be used in evaluating the corrective actions:

a. Failure analysis adequacy.

b. Appropriateness of corrective action.

c. Demonstration of corrective action by test.

d. Verification of future implementation of corrective action.

e. Evaluation of effectiveness of corrective action.

11-31. Reporting Corrective Action
Each activity with responsibility for corrective action will

report on the corrective actions taken for each failure mode. While the test is in progress, the responsible activities will provide the progress made on the first three steps cited above. A final assessment of all five steps will be made at the RAM Assessment Conference.

11-32. Reliability Failure Review Boards (AR 702-3)
After the test a Corrective Action Review Team (CART) meeting may be called by the materiel developer. The CART process is a tool which supports the MATDEV's required corrective action review process. Its purpose is to determine adequacy and effectiveness of planned and implemented corrective actions. The CART is an extension of the scoring conference and may be composed of the same members. The results of the CART are used by the MATDEV in developing estimates of projected system RAM characteristics. These estimates or projections may also be included in the independent evaluation and compared to the system's RAM requirements. If either evaluator disagrees with the RAM projections made by the CART, he includes his independent projections in the report and highlights his disagreement with the CART projections.

Section V
RAM Assessment Conferences

11-33. General
The procedures for scoring and assessment conferences were developed to allow a fair determination of RAM data bases (AR 702-3). The procedures provide a disciplined set of protocols and rules for conducting RAM conferences. Any spokesperson or conference chairperson who feels the intent of this document is being misconstrued should immediately report concerns to the command focal point for RAM who will assist in resolving the problem or in soliciting resolution of the matter through appropriate command/decision authority channels.

11-34. RAM Assessment Conference Objectives
A RAM assessment conference is held at the completion of each OT or before a major decision review. The objectives of the RAM Assessment Conference are to establish a common test data base and to determine "demonstrated" operational RAM estimates that serve as the baseline for all independent assessments.

11-35. RAM Assessment Conference Membership
The materiel developer, combat developer, independent operational evaluator, and independent developmental evaluator/assessor each

designate a single spokesperson for the assessment conference. Whenever possible the principal spokesperson is to be the same representative who participated in the scoring conference. Conference voting members include the four principal RAM spokespersons.

a. Personnel representing the development tester, operational tester, and other relevant government personnel also participate as required. The logistician is invited to assessment conferences as an observer and receives copies of conference results.

b. The principal spokespersons will make up the decision making body of the assessment conference. They will perform their function within the guidelines of the this pamphlet (supplemented by agreed upon operating procedures).

11-36. Assessment Conference Chair
The chair is the operational evaluator for all assessment conferences. The chair may be the voting member or the chairing command may provide a dedicated chairperson. The chair is responsible for maintaining order and allowing reasonable participation by all government participants to include voting members and observers. The chair will schedule all assessment conferences and be responsible for the following:

a. Administrative functions, including preparing and distributing conference minutes.

b. Ensuring that the conference is conducted effectively and efficiently.

c. Carrying out the procedures established by guidance documents (supplemented where necessary by consensus agreements of the principal spokespersons).

d. Ensuring system contractor personnel do not attend or directly participate in RAM Assessment Conferences which address data intended to support evaluation/assessment of their system's operational RAM parameters.

11-37. RAM Assessment Conference Procedures
The RAM assessment conference is conducted under the guidelines of scoring conferences, except that no tie breaking vote exists. The assessment conference reviews the test profiles and results, in conjunction with the OMS/MP, to identify which test phases or configurations are relevant for use in determining operational RAM estimates. Decisions are made by majority vote of principal

spokespersons. There is no tie breaking vote. In the event that no majority opinion is reached, then each agency reports its own RAM assessment and the magnitude and the basic reasons for the differences are elevated to the respective headquarters for necessary action. Unresolved differences are reported at decision reviews.

a. Attempts should be made to achieve the objectives of the RAM assessment conference by telephone or correspondence whenever possible; however, a conference will be held at the request of any of the principals.

b. If there is a significant difference of opinion at the RAM Assessment Conference, spokespersons must advise their respective headquarters of both the magnitude and the basic reasons for the difference. Unresolved differences will be reported at a decision review.

c. The DRMP will be used to review the test profiles and results to identify test phases or configurations that are relevant for use in determining RAM estimates. The test data base may be partitioned for analysis according to environmental conditions, stresses, and by systems, subsystems, or major items. A test designed in accordance with the DRMP eliminates the need for further adjustment. If the DRMP is not followed, procedures based on the relationship between DRMP and test profiles will be used.

11-38. Aggregation of Test RAM Data

Aggregation of data will be considered and will address all RAM parameters in the ORD. The conference determines if DT and OT data can be aggregated (NOTE: If the data are to be aggregated for ACAT I and II systems entering full rate production, the contractor involvement restrictions of PL 99-661 and PL 100-180 will also apply to the DT scoring and data collection).

a. When aggregation is not feasible, both DT and OT results will be separately presented at subsequent decision reviews with an explanation of significant differences. If data are not aggregated, the principals must provide a detailed explanation of the reasons in the conference minutes.

b. The main reason where DT data can not be aggregated with OT data is that DT is not normally conducted under operational conditions, with user troops and in conjunction with the OMS/MP.

11-39. Adjustment of Scored Data

The conference will determine which method of assessment provides

the most accurate representation of the system configuration at end of test. For tests conducted in accordance with the OMS/MP and the DRMP and with a fixed system configuration, no adjustment of the scored data will be considered, the demonstrated estimates are based on unmodified scoring conference results. For tests conducted with a changing and evolving system configuration, either Reliability Growth or Engineering Analysis techniques may be used in the determination of demonstrated RAM values.

a. Reliability Growth techniques provide an objective means for assessing the impact that fixes have had on the reliability of the hardware tested. Reliability growth tracking techniques can assess demonstrated reliability of a system and provide an objective means for assessing the impact that fixes have on the reliability of the hardware tested. These techniques may be applied to systems, subsystems, or major items. The analysis may be further divided according to environment or other test conditions. MIL-HDBK-189, Reliability Growth Management, is a principal source of statistical methodology for assessing the reliability growth aspects of the Army programs.

b. Engineering analysis techniques make use of engineering judgement and test data in assessing the impact of fixes on the RAM of the system configuration and may be used to assess the final test data base. The principal spokespersons will determine if the classification status of corrected failure modes has changed, based on the five steps in paragraph 11-30, above,

(1) Each principal spokesperson subjectively determines if the chargeable status of corrected failure modes has changed based on failure analysis adequacy, effectiveness of corrective action, and verification of the fix through testing after corrective action was implemented.

(2) A failure identified as "not relevant" will not be used for computing the demonstrated estimate if a majority of the principal spokespersons agree that there is concrete evidence that a failure mode will not recur in operational environments, and the fix does not create any new failure modes.

(3) If the failure rate of a particular mode has been reduced to a lower rate (but the mode has not been eliminated), the failure rate observed after the change will be prorated for the entire test length.

(4) Only fixes that have been verified effective by adequate government testing of system, subsystems, or components (as determined by the four voting members of the assessment

conference) may be used to reduce the number of relevant failures.

c. As chairman of the RAM assessment conference the independent operational evaluator insures, using the above procedures and others in AR 702-3, that the resulting RAM estimates are realistic and represent what can be expected of the tested system.

11-40. Contractor Participation in Assessment Conferences

Contractor Involvement. System contractor personnel will not participate in RAM assessment conferences which address data intended to support evaluation or assessment of the system's operational RAM parameters.

11-41. RAM Assessment Conference Products

The chairman will publish minutes of the assessment conference giving results of assessment and RAM calculations based on conference results. Products of the conference are incorporated into the minutes and include:

a. The common data base under which all assessment for achievement of RAM requirements will be evaluated.

b. Demonstrated RAM estimates that serve as a baseline for all independent assessments.

Section VI
RAM Estimates, Assessments, and Predictions

11-42. Resolution of Differing Estimates

The proper fora to identify and resolve differences are the scoring and assessment conferences. Where differences exist (such as scoring or data base determination) between individual agencies and RAM Assessment Conference determinations, a failure-by-failure explanation is provided in evaluations, assessments, or test reports. Unresolvable differences will be elevated to appropriate headquarters before any decision review.

11-43. Individual RAM Estimates

Independent RAM estimates may be developed by the independent evaluators/assessors, materiel developer, and combat developer, based on analysis of the test data base, if done appropriately.

a. Any deviations from the agreed upon categorization or demonstrated estimates will be clearly identified to provide a

well established audit trail.

b. Reports and decision briefings will address relationship of the independent estimates to demonstrated estimates. The reports or briefings will provide supporting rationale for independent estimates.

c. Independent estimates may result from different incident assessment criteria, projections based on corrective actions, differences in analytical techniques, or other variations in data base presentations. Independent estimates are valuable in gaining maximum insight into RAM data bases and the performance and potential of the system.

11-44. Failure to Demonstrate RAM Requirements
When the requirements have not been demonstrated, projected RAM estimates will be developed before the next acquisition phase.

a. The materiel developer will develop projected values using test data, engineering judgment, and other pertinent information to estimate RAM performance expected at the beginning of the next phase or in field operations. The materiel developer will provide projected values to the scoring conference participants and will define the rationale used to develop them.

b. A projection can account for proposed fixes incorporated after the end of test, and for late fixes that were incorporated near the end of the test period. However, the projection may not be fully reflected in the demonstrated RAM values because of limited test exposure.

c. The IOE will report to the Vice Chief of Staff of the Army an assessment of the effectiveness of the incorporated and proposed fixes. All independent evaluators/assessors will report predicted RAM values.

11-45. Breaching of RAM Thresholds
If the point estimate for a RAM parameter is below the threshold, the assessment conference will conduct analyses to determine if a threshold breach has occurred. Inputs to this analysis include:

a. Engineering estimates from design disciplines (e.g., thermal analysis, worst case analysis, failure modes effects, and criticality analysis).

b. Contractor test results (e.g., reliability demonstration, component/subsystem testing, factory screens and acceptance tests).

c. DT point estimates and confidence intervals.

d. OT point estimates and confidence intervals.

Section VII
Operational Reliability Analysis

11-46. General
In order to address the reliability of a system, the RAM analyst must have a clear understanding of its planned operational environment.

11-47. OMS/MP
The specific conditions for system operation (e.g. mission types, frequency, and duration(s), required tasks, and environment) are established in the OMS/MP. The OMS/MP originates as an annex to the MNS and is refined for use in developing RAM requirements in the RRR.

11-48. FD/SC
The analyst must also be intimately familiar with the FD/SC, also contained in the RRR. The FD/SC contains the agreed upon guidelines for classification and chargeability of test incidents and lists the system's mission essential functions. Test incidents are classified with the FD/SC based on their effect on the system's mission and logistics oriented reliability.

11-49. Reliability Classifications
The most common reliability classifications in OT&E are listed in Table 11-4.

(Insert Table 11-4)

a. Other classifications are acceptable if justified by a peculiar system or its mission. For example, another mission reliability classification is Mission Aborts. If a system performs several functions, emerging TRADOC (CASCOM) terminology reflects the use of Mission Aborts (MA) and Mission Affecting Failures (MAF). OMF has always been a compromise term lying to the middle of the spectrum between a MAF and a MA. MA can be used with MAF to differentiate between those failures which abort a mission versus those which degrade mission effectiveness. In the hierarchy shown in Figure 11-3, MA are a subset of MAF which are in turn a subset of EMA.

b. Systems most likely will not have requirements for all the

reliability classifications listed in Table 11-4, but if warranted, these reliability classifications should be addressed with an investigative issue(s) in the IEP or TEP.

c. The analyst must understand the relationship between and impact of the various mission and logistics oriented reliability classifications selected for the system. Since mission reliability considers only critical failures, the mission reliability of a system is normally higher than the logistics reliability. However, some systems which have only a few failure modes may have no substantial difference between the mission and logistics reliability.

d. Figure 11-3 illustrates the relationship of the most common reliability classifications.

(Insert Figure 11-3)

11-50. Reliability Redundancy
In order to assess mission reliability, the subsystem malfunctions which cause the loss of a mission essential function and the redundant features of the system must be clearly established. One recommended method is to include in the FD/SC a matrix which correlates the mission essential functions to specific subsystems. An example this type of matrix is provided in Figure 11-4. Use of this matrix does not imply that mission essential functions are only lost through hardware or software malfunctions. Operational reliability assessment includes failures which are caused by others (chargeable to accident, crew, manuals, maintenance personnel, support equipment, and training).

(Insert Figure 11-4)

11-51. Probabilistic Reliability
Reliability is expressed as the probability that a system will operate at a given level of functionality under a specified set of conditions for a specified period of time. The given level of functionality is specified in the FD/SC through identification of mission essential functions and maximum levels of degradation for those functions. The specified set of conditions is defined by the OMS/MP. The specified period of time is given by the mission length in the OMS/MP.

11-52. Mean-Time-Between-Failures (MTBF)
The development of a reliability requirement usually assumes that the failure rate of the mature system will be constant over a long period. This assumption allows the reliability requirement

to be expressed, not as a probability, but as an easily measurable parameter directly related to reliability. For hardware reliability, this parameter is the MTBF, or for operational reliability, the mean time between operational mission failure (MTBOMF).

11-53. Reliability requirements

A primary responsibility of the operational RAM analyst is to assess the extent to which the system meets the operational reliability requirement. Early participation in the RRR Working Group by the evaluator or RAM analyst, provides the opportunity to impact the elements which drive the assessment of operational reliability requirements.

11-54. Independent Reliability Assessment

An "Army" assessment of reliability is made at the assessment conference using data scored in accordance with the approved FD/SC. The independent evaluator participates in this assessment and includes it in the independent evaluation (but is not limited by it). In his independent assessment, the evaluator addresses the many considerations which are relevant to system reliability and its understanding. The following topics are to be considered when developing an independent assessment of operational reliability.

a. If substantially different failure rates occur across test phases, scenarios or other test periods, the reliability analysis may need to be segmented or analytically developed from the separate reliability estimates for each test phase, depending on the reason for the difference. This is a real concern when different test scenarios or phases use different system configurations or exercise different system capabilities (e.g., a live fire phase and a dry fire phase). In addition, it is a concern when different test scenarios or phases are conducted with different intensities of operation or under different test or environmental conditions.

b. If there were any modifications or configuration changes made to the system during the conduct of test, consideration is to be given to the use of reliability growth as a technique for estimating the reliability.

c. If there are any critical failures which must be corrected prior to fielding the system, the operational reliability is to be estimated both as tested and assuming the failure is successfully corrected.

d. If the independent evaluator submitted any dissenting

opinions on operational mission failures at either the scoring or assessment conferences, he reports the reliability as scored by the scoring conference and independently estimates the reliability based on his independent scores.

e. If there are pattern failures or there is a particular system function, test condition, or failure category (hardware, crew, software, maintenance, etc.) which caused an inordinately high number of failures, particular attention is to be given to possible means of correction through training, system redesign, changes to operating procedures, etc. The objective of this type exploration is to extend the reliability analysis past a record of what happened in test, to an analysis which provides insight into the potential reliability of the system.

f. If the independent evaluator disagrees with the assessment conference decision on whether to aggregate data from more than one test, the evaluator develops an independent estimate from his preferred data set and supports it with a discussion of why he disagreed with the aggregation decision. In making the aggregation decision, particular attention is to be given to the extent to which different approaches to test conduct and equipment management might have impacted failure data.

g. If a test consists of more than one test item of a given type, the RAM analyst checks to insure that the failure rate is consistent across similar pieces of equipment. Whenever a test item or group of items is found to differ substantially from the other equipment, explanations are to be sought in terms of item age, component age, abnormal crew stress, abnormal test intensity, etc. Depending on the magnitude of the difference between the failure rates and the number of items involved, separate reliability estimates may be required, an estimate may be required excluding the atypical items, or if the cause can be identified, some other appropriate adjustment to the data may be required.

h. After the process of analyzing the failure data, carefully considering the above factors and adjusting the data where appropriate, the RAM analyst estimates the operational reliability and compares it to the requirement. Estimates are made based on the tested configuration as well as estimates projected to IOC assuming planned and required fixes are successfully implemented and demonstrated by testing.

i. Any minority score used in the independent reliability estimate is to be clearly identified along with the rationale supporting the minority opinion.

j. When the equipment is modified between test phases or between tests conducted under similar conditions, test control procedures and intensities, and if most of the failures are chargeable to hardware, reliability growth methodology is to be considered in projecting reliability estimates to the IOC time frame. The methodology is detailed in MIL-HDBK-189, 13 Feb 1981, and is a powerful tool for projecting failure rates from test data taken on systems which have undergone modification. Additional literature on the reliability growth technique is found in MIL-STD-781-D, 17 Oct 1986; MIL-HDBK-781, 14 Jul 1987; and MIL-HDBK-338, 15 Oct 1984.

k. The RAM analyst also assesses the combined OMFs and essential maintenance actions (EMAs) in a manner similar to that discussed above except that there are usually no requirements against which to compare the parameter estimates. He also analyzes the combined OMFs, EMAs and unscheduled maintenance actions (UMAs) in a similar manner. Resulting parameters are included in the evaluation and interpreted appropriately.

Section VIII
Operational Availability Analysis

11-55. General
The RAM analyst estimates the operational availability (A_O) requirement based on the wartime OMS/MP. Because the meaning of the A_O requirement is dependent on specific assumptions for Administrative and Logistics Downtime (ALDT), specific parameters defined in the wartime OMS/MP and specific definitions in the FD/SC, assessment against the requirement must be subject to the same assumptions.

11-56. Measuring A_O in OT
Exclusive use of test data do not usually provide a responsible estimate of the A_O requirement. The analyst uses the test data to estimate the components of A_O making sure they conform to the assumptions of the requirement. The ratio of standby time to operating time needs to approximate that required by the OMS/MP, and the ALDT needs to approximate that assumed in the requirement.

11-57. Assessment of A_O from OT Data
When test data do not provide a good estimate of individual components, values assumed in development of the requirement are substituted.

a. As an example, the test estimate of ALDT is usually unrealistic as it is not subject to the logistic supply system used in the field or to numerous other factors which drive up its value (e.g., delays due to other systems competing for maintenance or supply resources). When this is the case, the ALDT estimate assumed in development of the requirement is substituted for the test ALDT.

b. If the test was not long enough for the system to experience a representative sample of preventive maintenance (PM), the amount of PM per operating hour assumed when developing the requirement is substituted for that experienced in test.

c. The analyst calculates the A_0 subject to his best analytical judgment with respect to the use of test data or alternative estimates for the A_0 components. The computed value is then subjectively compared to the wartime A_0 requirement.

d. On some systems it would also be important for the evaluator to address the Peacetime Availability because of system support cost and readiness requirements. For example, the most important aspect of a nuclear missile is that it be available if required.

11-58. Assessing Availability through Models

a. Often the operational evaluator is faced with a test limitation stemming from fewer test items being available than would be needed to equip the smallest size unit which would normally fight with the system. This is typical for systems which are networks or systems of systems. For example, a Remotely Piloted Vehicle (RPV) battery would be fielded with three forward control stations and two each rear control stations, launchers and recovery platforms. The RPV IOT was conducted with only one of each major assemblage.

b. To overcome this type of limitation, a model may be useful for representing the unit's ability to accomplish its mission, taking into account redundancy, tactical procedures for the entire battery, and priorities of the flights requested. The objective of such a model would be to use the RAM measures based on the test finding for each assemblage type in order to estimate the mission availability or productivity for the basic fighting unit.

11-59. Operational Availability Computational Procedures

a. A_O are the most common measures of System Readiness Objectives (SRO). A_O may be defined as the ratio of uptime to total time, the ratio of operating time and standby time to total time, the percentage of systems required to be operational (e.g., 8/10 = .80), or the probability of being able to start a mission.

b. The components of A_O (i.e., operating time, uptime, and standby time) also have many definitions and interpretations.

c. Peacetime Operational Availability (A_{OP}). In general, the equation shown in figure 11-5 should be used for assessing A_{OP} whose estimates consider all calendar time, maintenance time, and ALDT.

(Insert figure 11-5)

(Insert figure 11-6)

d. Wartime Operational Availability (A_{OW}). Estimates of A_{OW} are to be derived using the formula shown in figure 11-6. Total calendar time is not used to calculate (A_{OW}) in testing. Garrison time, weekends, and holidays when no testing is scheduled are excluded. Standby time is included only if it is part of the system's mission requirements (e.g., "hide" mode). Figure 11-7 and 11-8 recommend data sources and adjustments to the components of A_{OP} and A_{OW}.

(Insert figure 11-7)

(Insert figure 11-8)

e. Logistics supportability data will be categorized using the ILS elements and their impact on A_{OW} with measured adequacy of the SSP, a critical item in the evaluation of A_O.

f. Since A_O is difficult to precisely measure in the test environment, sensitivity analyses have to be planned to indicate how changes in the logistics supportability measures affect availability. Figure 11-9 gives an example of one way to show this sensitivity.

(Insert figure 11-9)

Section IX
Maintainability Analysis

11-60. Maintenance Measures

Maintenance times include diagnostic time, active maintenance time (replace, adjust or repair) and test or checkout time. Logistics or administrative delays in maintenance are not included. Analysis of these maintenance times is typically focused on two primary operational parameters, the mean time to repair (MTTR) and the maintenance ratio (MR). MTTR is the average clock time to perform active corrective maintenance. MR is the manhours of maintenance expended per hour of operation. MTTR and MR are normally calculated for each maintenance level for the system as well as a total MTTR and MR for the overall system. Estimates of these parameters (or others when addressed in the requirements document) are compared to the operational maintainability requirements and augmented by an analysis of their implications on the units capability to provide the requisite maintenance support.

11-61. Maintenance Calculations

Analysis of maintainability data include:

a. Maintenance times from test are individually compared to Maintenance Allocation Chart (MAC) estimates. If observed times differ excessively from the MAC estimates, they are highlighted as they indicate potential problem areas.

b. Maintenance times which are exceptionally long or short compared to other times for the same maintenance action, are considered for analytic treatment as outliers or, if the circumstance can be determined to be atypical, for elimination from the estimate against the requirement. The best statistical treatment of maintenance data with outliers is to use a Lognormal (Pareto) Distribution to compute the measures of central tendency and dispersion for the data set. The Lognormal Distribution is especially applicable to MTTR.

c. The distribution of maintenance times is to be checked in order to uncover any excessive maintenance actions which would significantly drive up the maintenance parameter estimates. If excessive times are found, they are to be highlighted and ways to reduce them are to be explored (see Lognormal Distribution, above). When appropriate, the maintenance parameters can then be calculated both as tested and as projected based on any proposed fix.

d. The proportion of individual maintenance actions attributable to diagnostics is investigated and when found to be large, highlighted as a problem area. Also when the required

BIT, BITE and TMDE have not been made available for test, an analysis is performed of the potential reductions in diagnostic time which can reasonably be expected when the BIT, BITE and TMDE are fielded. Maintenance parameters are to be expressed as tested and as projected based on this of type analysis.

e. The distribution of maintenance workload over maintenance echelons is expressed in terms of a Maintenance Burden (MB). It is used to estimate the impact on each maintenance echelon of the workload imposed by the new system when considered in combination with the workload imposed by existing systems.

f. Maintenance times which were affected by test peculiar circumstances are to be singled out and excluded in the estimates of the required maintenance parameters. This includes circumstances where the maintenance procedures used were substantially different from those prescribed in the manuals, were executed by personnel other than prescribed to perform the maintenance action, were supported by equipment not normally authorized at the prescribed maintenance echelon, or were executed by maintenance personnel solely dedicated to the test.

g. When there is enough data on a particular maintenance action to show a distinct learning trend, use the data associated with the mature maintenance capability for maintainability analysis.

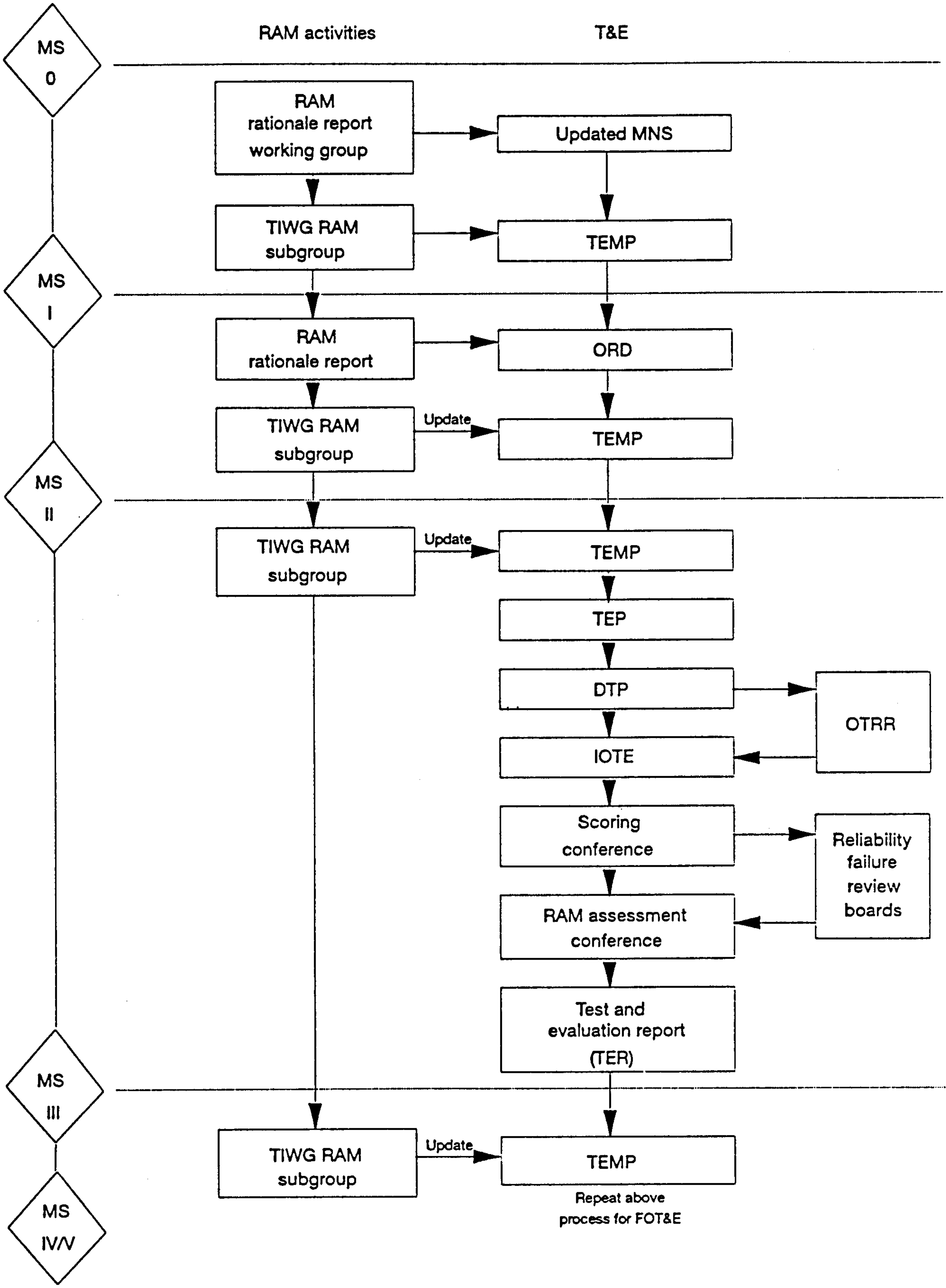


Figure 11-1. The RAM process in relation to T&E.

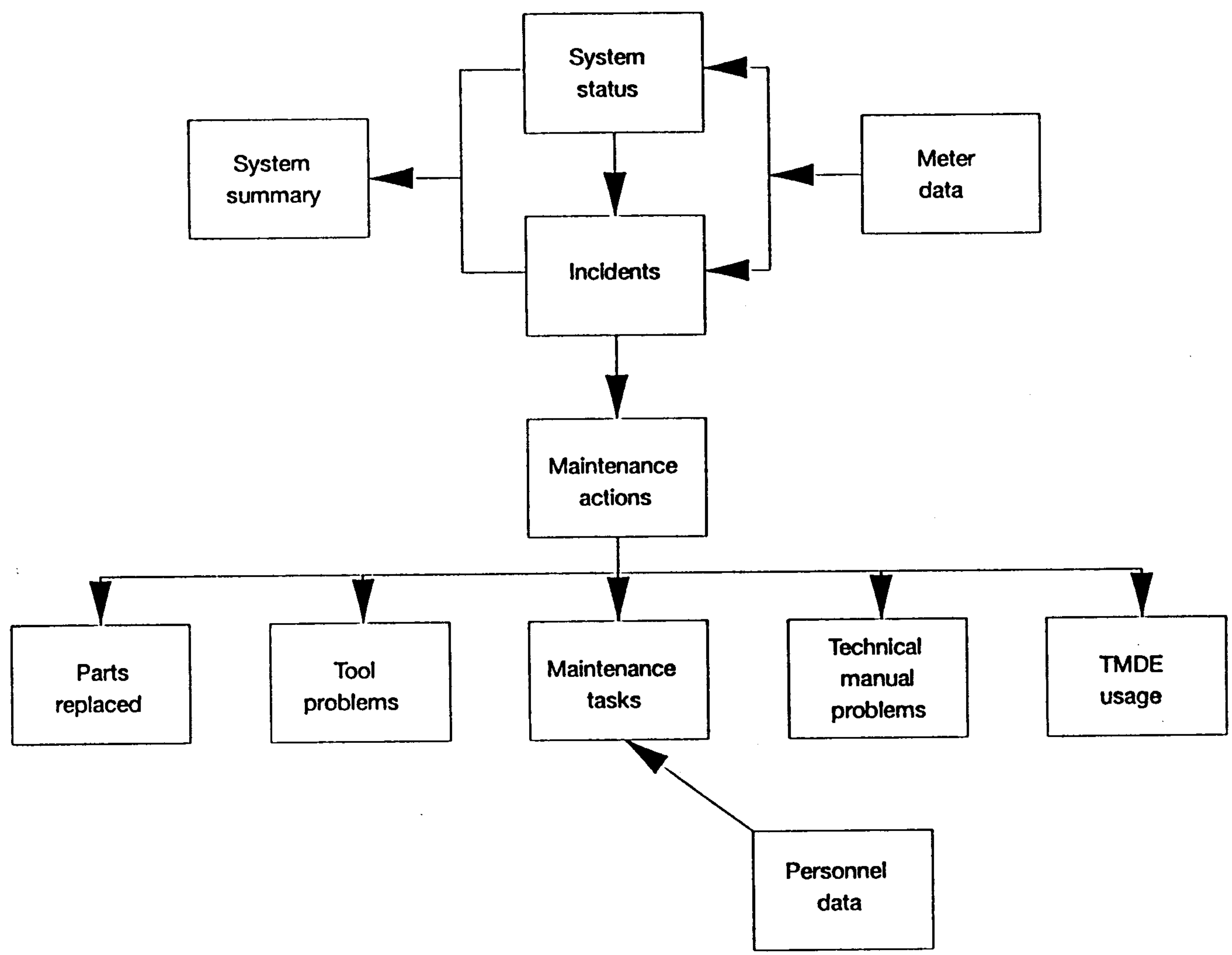


Figure 11-2. OTERAM.

Figure 11-3. <u>Reliability Incident Classifications</u>

UMA
EMA
(MAF)
OMF
(MA)
H/S Failures

Figure 11-3.

Figure 11-4. Mission Reliability Matrix

SUBSYSTEM	MISSION ESSENTIAL FUNCTIONS Move	Shoot	Communicate
Engine	X(1)		
Vehicle	X		
FLIR		X(2)	
Main Gun		X	
Co-Axial Gun		X	
Intercom			
UHF Radio			X(3)
VHF Radio			X(3)

NOTES: (1) Must have capability to sustain a minimum of 30 mph for mission duration.
(2) Required for night missions only.
(3) Only one UHF or VHF radio is required to be operational for a mission.

Figure 11-4.

$$Aop = \frac{TOT + TST}{TOT + TST + TCM + TPM + TALDT}$$

Aop - Peacetime operational availability
TOT - Total calendar operating time
TST - Total calendar standby time
TCM - Total chargeable corrective maintenance time during calendar time
TPM - Total chargeable preventive maintenance time during calendar time
TALDT - Total chargeable administrative and logistics downtime during calendar time

Figure 11-5. Equation for peacetime operational availability.

$$Aow = \frac{TOT + TST}{TOT + TST + TCM + TPM + TALDT}$$

Aow - Wartime operational availability
TOT - Total operating time during mission scenario
TST - Total mission standby time
TCM - Total chargeable mission critical corrective maintenance time
TPM - Total chargeable mission critical preventive maintenance time
TALDT - Total chargeable mission critical administrative and logistics downtime

Figure 11-6. Equation for wartime operational availability.

	Component	Units	Data source	Adjustments
Peace time operational availability	Operating time	Clock hours	Peace time OMS/MP	None may require conversion in ____ units
	Standby time	Clock hours	Peace time OMS/MP	None
	Total corrective maintenance time	Clock hours Manhours	Operational test	Adjust to annual peace time OMS/MP. *K factor adjust for failure/maintenance analysis
	Total preventive maintenance time	Clock hours Manhours	Operational test	Adjust to annual peace time OMS/MP *K-factor adjust for failure/maintenance analysis
	Administrative logistics downtime	Clock hours	Model simulation; average from RAM rationale report	None

*K-factor - ratio maintenance manhours to maintenance clock hours.

Figure 11 7. Peace time operational availability component breakout.

WARTIME OPERATIONAL AVAILABILITY A_{ow}

COMPONENT	UNITS	DATA SOURCE	ADJUSTMENTS
MISSION OPERATING TIME	CLOCK HOURS	OPERATIONAL TEST-OMS/MP	NONE UNLESS TO WARTIME OMS/MP OR CONVERSION IN LIFE UNITS
MISSION STANDBY TIME	CLOCK HOURS	OPERATIONAL TEST-OMS/MP	NONE UNLESS TO WARTIME OMS/MP
* MISSION CRITICAL CORRECTIVE. MAINTENANCE TIME	CLOCK HOURS MANHOURS	OPERATIONAL TEST	NONE UNLESS FOR FAILURE/MAINTENANCE ANALYSIS; K-FACTOR
* MISSION CRITICAL PREVENTIVE MAINTENANCE TIME	CLOCK:HOURS MANHOURS	OPERATIONAL TEST	NONE UNLESS FOR FAILURE/MAINTENANCE ANALYSIS K-FACTOR
MISSION CRITICAL ADMINISTRATIVE LOGISTIC DOWNTIME	CLOCK HOURS	MODEL;SIMULATION; AVERAGE FROM RAM RATIONALE REPORT	NONE

*FROM MISSION ESSENTIAL FUNCTION OR EQUIPMENT LIST, DASH 10 MANUAL, SAFETY

Figure 11-8.
Wartime Operational Availability Component Breakout

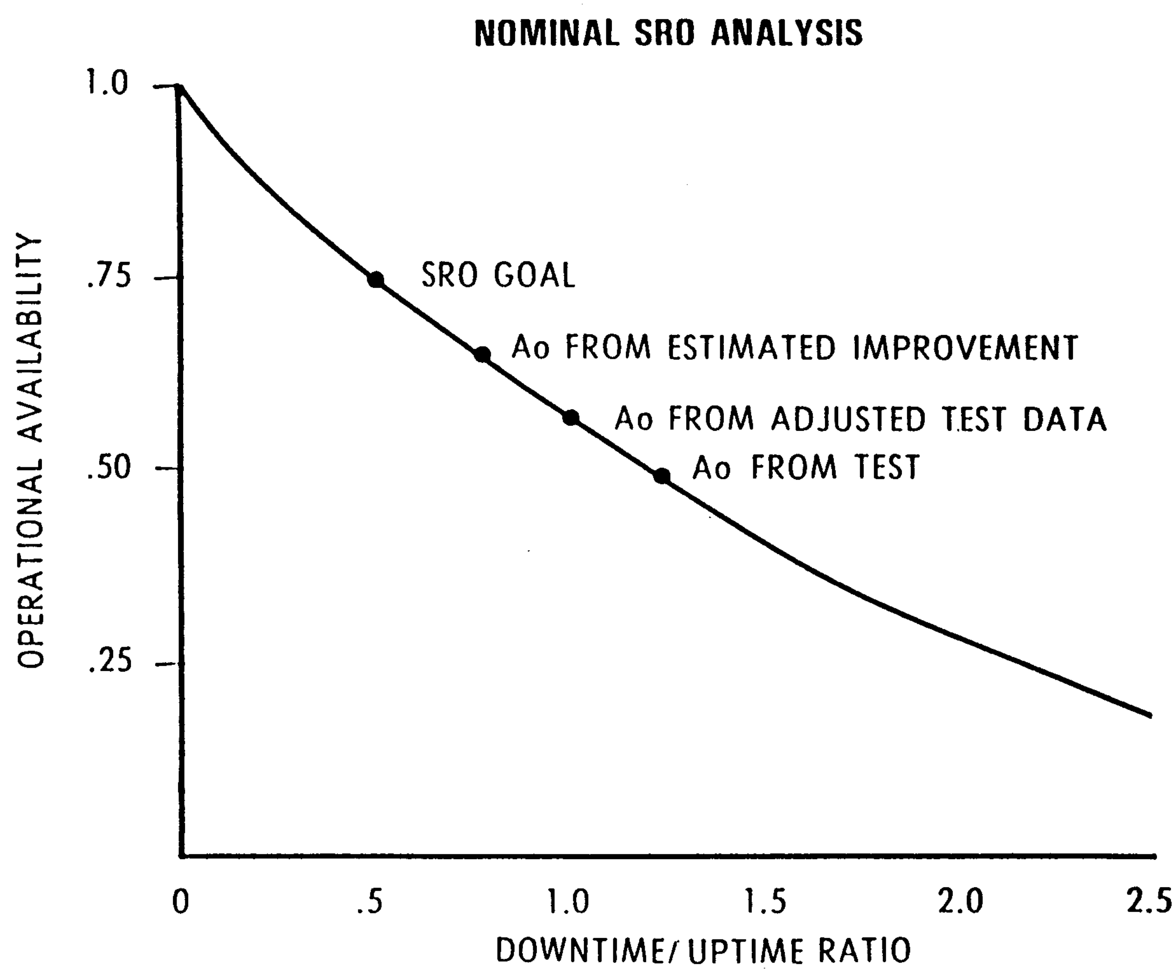


Figure 11-9. Example Illustration of Sensitivity and Operational Availability Data to Changes in Logistics Support Data.

Table 11-1. Reliability Terminology.

Reliability. The probability that an item can perform its intended functions for a specified interval under stated conditions.

Mission Reliability. The probability of completing a mission for a period of time under conditions stated in the mission profile. Mission reliability addresses failures which cause either degradation in mission performance or mission aborts.

Logistics Oriented Reliability. (Sometimes labeled logistics support frequency) The rate at which demands for logistics resources are made, regardless of the impact on the mission. The logistics rates typically measured are for unscheduled maintenance actions, essential maintenance actions, and part removals.

Table 11-1. Reliability Terminology.

Table 11-2. Maintainability Terminology.

Maintainability. The ability of an item to be retained in or restored to a specified condition when maintenance is performed by personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair.

Mean Time To Repair (MTTR). The total corrective maintenance action downtimes divided by the total number of corrective maintenance actions during a given period of time.

Maintenance Ratio (MR). A measure of the maintenance manpower required to maintain an item in an operational environment. It is expressed as the cumulative man-hours of corrective and scheduled maintenance expended in direct labor during a given period, divided by the cumulative item usage (e.g., hours, miles, or cycles) during the same time.

Table 11-2. Maintainability Terminology.

Table 11-3. Availability Terminology.

Availability. A measure of the degree to which an item is in an operable and committable state at the start of the mission, when the mission is called for at an unknown (random) point in time.

Operational Availability (Ao). The proportion of time a system is either operating or is capable of operating, when used in a specific manner in a typical maintenance and supply environment. All calendar time is considered. Ao is typically calculated for both the war and peace time environments.

Table 11-3. Availability Terminology.

Table 11-4. <u>OPERATIONAL RELIABILITY CLASSIFICATIONS</u>

Crew Correctable Maintenance Action (CCMA). (Optional)

Operational Mission Failure (OMF). Any incident or malfunction of the system that causes (or could cause) the inability to perform one or more designated mission essential functions.

Essential Maintenance Action (EMA). (Optional) Log R

Unscheduled Maintenance Action (UMA). Log R

Table 11-4. Operational Reliability Classifications.

Chapter 12
MANPRINT Considerations in Test & Evaluation

Section I
Introduction

12-1. Human Systems Integration (HSI)
DoDI 5000.2, Defense Acquisition Management Policy and Procedures, identifies a Human Systems Integration (HSI) program. This initiative seeks to reduce dependence upon unrealistic or unsustainable levels of human performance and human resources. The Army's version of HSI is the MANPRINT program (AR 602-2). MANPRINT is an engineering analysis and management process to identify and articulate requirements and constraints of human resources, human performance, and hazards to personnel so these matters will influence system design.

12-2. Human Performance
MANPRINT in test and evaluation (T&E) seeks to determine whether human performance problems degrade overall system performance. Soldier performance on critical tasks is the underlying concept here. In addition to system design, procedures can have profound effects upon human performance and also need to be examined during T&E.

12-3. Purpose
This chapter reviews MANPRINT in T&E, identifying what needs to be accomplished and who is responsible for the action. Requirements are presented throughout the phases of continuous evaluation (CE) and issue development, T&E planning and preparation, data collection and authentication, evaluation, and reporting.

12-4. Evaluator & tester relationship
The evaluator is responsible for MANPRINT CE and evaluation of test data. The tester is responsible for developing data collection instruments and then collecting MANPRINT data during a test.

12-5. Goal
When human performance or other MANPRINT problems are identified, their circumstances, causes, and potential solutions need to be determined. Solutions can include changes in system design, tactical procedures and techniques, manpower and organization,

personnel, and training.

Section II
Continuous Evaluation Methodology

12-6. MANPRINT issues

MANPRINT CE strives to resolve human performance issues before an Initial Operational Test and Evaluation (IOT&E) or a fielding decision. The evaluator assesses a system's MANPRINT status as part of the overall responsibility to perform CE. This involves identifying MANPRINT issues and tracking attempted resolutions. Unresolved MANPRINT issues ultimately addressed in test and evaluation planning.

a. System efficiency and effectiveness issues. CE identifies problems and potential changes for improving total system performance. Such changes may involve modifications in:

(1) Hardware and software designs

(2) Manpower

(3) Personnel

(4) Training

(5) Procedures and techniques

b. Health/Safety issues. CE also seeks to identify detrimental health or safety effects of system operation, maintenance, and support.

12-7. CE

MANPRINT CE consists of two general activities - assessing status and communicating evaluation plans.

a. Assessing MANPRINT status

(1) A major source of information for status assessment is the System MANPRINT Management Plan (SMMP).

(a) The SMMP is the integrated planning document for all MANPRINT activities and analyses associated with system acquisition. The SMMP includes human performance issues, data

sources, and plans for front-end analyses (FEA). Updated at the beginning of each developmental phase, it influences all requirements documents, solicitation documents, and T&E planning documents. It also influences planning documents for combat and training development.

(b) The SMMP must provide the basis for developing testable evaluation issues and criteria about human performance and its contribution to system performance. It must also contain the Target Audience Description (TAD) so that test participant representativeness can be determined. (See Figure 12-1.)

(insert Figure 12-1)

(2) The MANPRINT Joint Working Group (MJWG) is responsible for developing and updating a SMMP for every mission area deficiency requiring a new development solution. The combat developer [usually the Training and Doctrine Command (TRADOC) or the PM for Information Mission Areas (IMA) systems] is responsible for forming the MJWG.

(a) The MJWG consists of representatives, from the School and post, with expertise in a MANPRINT domain. They include the Directorate of Combat Developments, Directorate of Training and Doctrine, TRADOC System Manager (if appointed), Specialty Proponency Office, Post Safety Office, and Army Research Laboratory (ARL) - Human Research and Engineering Division (HRE) field office.

(b) There are also consulting members of the MJWG. These may include representatives from the Army Materiel Command (AMC), the Project Manager's Office, technical testers and evaluators, and operational testers and evaluators.

(3) Information from agencies evaluating specific aspects of the MANPRINT program should be reviewed.

(a) The Health Hazard Assessment Report (HHAR) prepared by the Army Environmental Hygiene Agency (AEHA) or the Medical Research and Development Command (MRDC).

(b) The Human Factors Engineering Analysis (HFEA) prepared by ARL-HRE. The HFEA deals primarily with HFE issues, although it may also address system safety and training.

(c) The Manpower-Personnel-Training (MPT) Assessment

prepared by the Deputy Chief Staff for Personnel. This assessment is prepared by the DCSPER for major systems before each milestone review. This combines the results of tests, studies, and analyses related to human factors. The combat and materiel developers jointly prepare the MANPRINT Assessment for non-major systems.

(d) The System Safety Management Plan (SSMP) prepared by the System Safety Working Group (SSWG). SSWG co-chairmen represent the PM and the Safety Office of the affiliated AMC major subordinate command. SSWG members are from basically the same organizations as those represented on the Test Integration Working Group (TIWG). The SSMP is a source of safety and health hazard issues for consideration in the System MANPRINT Management Plan (SMMP). The SSMP guides system safety engineering and testing efforts conducted by the developing contractor.

(e) Safety Assessment Reports (SAR) prepared by the system contractor for the PM. The PM's office, with the help of its supporting safety office (from a major subordinate command of AMC), prepares the System Safety Risk Assessment (SSRA). For some systems, the Army Safety Center provides an Independent Safety Assessment based upon the SSRA.

(f) Critical tasks identified by the combat developer.

(g) The results of early operational testing requested by combat and training developers. Such testing includes mockups, prototypes, or competing hardware and software. Applicable tests include Concept Evaluation Program (CEP), Force Development Test and Experimentation (FDTE), Early User Test and Experimentation (EUT&E), Training Effectiveness Analysis (TEA), and Limited User Tests (LUT). These tests support:

(1) Identification and validation of operator and maintainer critical tasks.

(2) Identification and development of testable human performance issues.

(3) Development and validation of Measures of Performance (MOP) and operational standards for human performance.

(4) Examination of Tables of Organization and Equipment (TOE) design options. Examples are mixes and options for organization, MOS or Civilian Job Series (CJS), and personnel

numbers.

(5) Design and validation of training programs.

(6) Examination of operating procedures and techniques. Procedures can be in the form of tactical Standard Operating Procedures (SOPs).

(7) Examination of alternative hardware and software design features, especially with prototypes and mockups.

b. Communicating MANPRINT aspects of operational evaluation planning activities to system developers

(1) Formal mechanisms include the TEMP, TEP, and periodic operational assessments.

(2) Informal mechanisms include participation in the various working groups dealing with MANPRINT (MJWG, SSWG, TIWG).

12-8. MANPRINT Evaluation Data Base (MEDB)
OEC uses information from the previously mentioned sources to identify MANPRINT issues and develop OT&E plans beginning early in the acquisition process. The system's MANPRINT status is then tracked by maintaining its MEDB. The MEDB's fields are listed in Table 12-1.

(insert Table 12-1)

Section III
DT&E Planning and Preparation

12-9. Developmental Test and Evaluation (DT&E)
The DT&E MANPRINT goal is to determine if the system design allows it to be operated and maintained by the designated number of soldiers representative of the target audience description, with the proposed system training and under the expected use conditions. Developmental tests requiring the use of military personnel to operate, support, transport, erect, occupy, or use the equipment when fielded should ideally use, as test participants, Soldier-Operator/-Maintainer T&E (SOMTE) personnel. These are military personnel who are trained as developmental testers for assessing the soldier-machine

interface during DT. The developmental IEP/IAP specifies a requirement for the operation and maintenance to be performed by SOMTE personnel.

a. Critical Technical Parameters addressing MANPRINT issues are included in Part III of the TEMP.

b. The MANPRINT section of the developmental IEP/IAP addresses human factors engineering, system safety and health hazards, and the manpower, personnel, and training elements of ILS.

c. The Detailed Test Plans specify detailed test procedures to determine if requirements for human factors engineering, and system safety and health hazards have been met.

Section IV
OT&E Planning and Preparation

12-10. Operational Test and Evaluation (OT&E)

The major MANPRINT goal for OT is identification of system design features and characteristics which adversely affect users and maintainers. Human performance issues seldom appear as a Critical Operational Issue and Criteria (COIC). They are usually additional operational issues and criteria (AOIC) supporting effectiveness and suitability COICs. Examples of these type AOICs are:

a. Global MANPRINT issue and criterion.

(1) Issue: Are the human performance and human factors characteristics of the operation, maintenance, training, and support of the system acceptable in training and operational settings?

(2) Criterion: The system must be designed so that all critical tasks related to its operation, maintenance, and support can be performed by trained personnel without requiring either increases in planned manpower or training, nor greater aptitudes and abilities than expected in target MOS or CJS populations. Design characteristics must not create short- or long-term safety or health hazards.

b. Training aspects of the system. Training validity is

based on performance in the training setting. Performance validity is based on the transfer of training to performance in the operational setting.

(1) Training Validity

(a) Issue: Do trainees learn the knowledge and skills?

(b) Criteria:

(1) Operator and maintenance training will qualify ninety percent of representative trainees to perform each critical task to the prescribed training standard.

(2) Collective training will qualify ninety percent of representative crews to perform each critical task to the prescribed training standard.

(3) Performance Validity

(a) Issue: Do the knowledge and skills provided by the training program(s) enable trainees to operate, maintain, and support the system effectively in an operational setting?

(b) Criteria:

(1) Operator and maintainer training will qualify ninety percent of the trainees to perform each critical task to the prescribed operational performance criterion under combat or other operational conditions.

(2) Collective training will qualify ninety percent of trained crews to perform each critical task to the prescribed operational performance criterion under combat or other operational conditions.

c. Human Factors Engineering (HFE) aspects of the system.

(1) Issue: What system design features adversely affect the ability of representative participants to operate, maintain, and support the system in an operational setting?

(2) Criterion: None, this is an investigative issue. (Not enough is known to completely specify all relevant MOPs and their standards as individual criteria.)

d. Manpower and organizational aspects of the system.

(1) Issue: Does the applicable TOE provide manpower resources for the effective operation, maintenance, and support of the system?

(2) Criterion: None, this is an investigative issue.

e. Personnel and personnel selection aspects of the system.

(1) Issue: Can the system be effectively operated, maintained, and supported by personnel in the MOS(s) or CJS(s) planned for the system?

(2) Criterion: None, this is an investigative issue.

f. Operational procedures and techniques aspects of the system.

(1) Issue: Do unit tactical SOPs provide operational procedures and techniques in enough detail to permit trained individuals and crews to operate, maintain, and support the system effectively in an operational setting?

(2) Criterion: This is an investigative issue.

g. System safety and health hazards.

(1) Issue: Is the system safe for personnel to operate, maintain, and support in operational and training settings?

(2) Criterion: There must be no safety or health hazards associated with the training, operation, maintenance, or support of the system having a Risk Assessment Code (RAC) with higher risk than IV-A, III-B, III-C, II-D, and I-E.

Note: The RAC concept is described in MIL-STD-882B. The particular RACs used in a criterion should conform to the risk management matrix prescribed in the SSMP and to the acquisition strategy (also see AR 40-10).

12-11. The operational evaluator
The operational evaluator takes the following steps:

a. Identifies MANPRINT issues not resolved prior to test.

b. Develops criteria and MOPs for these issues.

c. Ensures MANPRINT evaluation costs are contained in the Outline Test Plan (OTP).

d. Completes the MANPRINT portion of chapter two of the TEP.

e. Reviews chapter three of the TEP to ensure proposed data elements and their collection instruments and procedures meet MANPRINT evaluation requirements.

f. Makes a military subject matter expert's judgement of whether Safety Release (SR) restrictions permit adequate training and operational testing.

g. Evaluates individual and unit performance during pretest training in a manner consistent with OT&E scenarios and performance measures.

12-12. The operational tester
The operational evaluator takes the following steps:

a. Identifies MANPRINT data requirements, instruments, and collection procedures. Sample data items in Figure 12-2 are a topic menu for developing MANPRINT data and instrumentation requirements during test planning.

(insert Figure 12-2)

b. Ensures resources to support MANPRINT data collection and analysis (level three) are contained in the OTP.

c. Reviews chapter two of the TEP and responds in the MANPRINT portion of chapter three.

d. Ensures that the training developer knows the scope of operational test activities.

e. Ensures that the trainer issues the Operational Test Readiness Statement (OTRS) before the pilot test begins.

f. Ensures that test participants are representative of the MOS or CJS populations for operators, maintainers, and supporters. Given test player social security numbers, the Defense Manpower Data Center (DMDC) will compare them with all others in their MOS or CJS.

g. Ensures that the test design has been approved by a Human Use Committee (HUC) (AR 70-25) before the pilot test begins.

Section V
System Safety and Health Hazards

12-13. Requirements for Release
Systems will not be released to field troops or for testing by troops until the following requirements are accomplished (AR 385-16 and AR 40-10).

a. Evaluations of the system safety and health hazards of each item or system will be conducted throughout the T&E program. Safety testing will be conducted in accordance with approved international test operating procedures or TECOM test operating procedures for the specific system under test. The testing will assess personnel and equipment hazards inherent in the system and its associated operation and maintenance hazards. This testing will be considered early in the test - planning cycle and will continue throughout the acquisition process as an element of the normal test program for evaluation at each milestone. Special attention will be given to verifying the adequacy of safety and warning devices and other measures employed to control hazards. The adequacy of hazard warning labels on equipment, and warnings, precautions, and control procedures in equipment publications, will be evaluated. Moreover, commanders of the user units must be made aware of and agree to the safety and health hazards to which their units will be exposed.

b. Pertinent data from all testing (including contractor testing) will provide a basis to evaluate safety and health characteristics. In addition, separate/specific safety and health tests will be performed on hazardous devices, components, or by-products to determine the nature and extent of hazards presented by the materiel. Particular attention will be given to identifying and evaluating special safety and health hazards presented by radioactive materials, radio frequency emitters, toxic gases, laser devices, toxic and carcinogenic materials, gaseous emissions, blast overpressure, and harmful noise sources. Health issues that cannot be resolved within the T&E community will be elevated to the Surgeon General in accordance with AR 40-10.

c. Evaluators will ensure that T&E documentation provides an independent assessment of hazards and that the results of the safety evaluations are included in all evaluations. The developmental IER will contain a safety confirmation as required by AR 385-16.

d. Test organizations will ensure that:

(1) The DTPs for all developmental tests provide a developmental assessment of hazards, and the results are included in all TRs.

(2) Precautions are taken to protect personnel and equipment during tests.

(3) A safety assessment report is used to integrate safety into test planning and procedures and for shipping and handling the system.

(4) Government system-level testing does not begin until a safety assessment report, prepared by the program manager, has been received, reviewed, and accepted by the test organization.

(5) Pretest training for operational testing, and any other testing that uses soldiers not assigned to the test organization as test players, will not begin until a safety release has been reviewed and accepted by the test organization.

(6) Test plans are reviewed by the appropriate Human Use Committee (HUC).

Section VI
DT&E Execution

12-14. DT&E data collection

During developmental testing, the following MANPRINT-related data is collected:

a. Objective measurements (i.e., sound, lighting, vibration, workspace, temperature/humidity/ventilation) as required to document the adequacy of the soldier-machine interface.

b. Human performance measurements for SOMTE personnel completing operational and maintenance tasks relating to mission

performance.

c. Questionnaire and interview administration to obtain SOMTE personnel subjective input on ease of operation and maintenance, and adequacy of design to complete mission requirements.

d. Questionnaires and interviews to determine the SOMTE personnel's subjective input on the adequacy of new equipment training (NET).

Section VII
OT&E Execution

12-15. OT&E data collection
The tester collects data on human performance and other MANPRINT concerns during OT.

a. Data collection efforts include:

(1) Using health and safety related procedures as required by issues and criteria, the SR, and the HUC.

(2) Making direct, accurate, objective, and non-interfering measurements of player performance. These are time and accuracy measures of behavior related to MOPs. Measurements include both individual and group performance.

(3) Video taping soldier activities, particularly where they can not be directly observed.

(4) Getting observations and ratings from expert observers, including observations about videotaped activities.

(5) Integrating MANPRINT data into the system's overall test data base:

(a) Performance data

(b) Users' opinions about the operating characteristics of hardware and software design features and operating procedures

(c) Individual characteristics of test participants

(aptitude test scores, anthropometric measures, etc.)

b. Provides level three data to OEC.

(1) Automated data base with linked files containing related data elements.

(2) Reduced manual data with indexed printouts, spreadsheets, etc.

(3) Edited audio/video tape.

12-16. Data Authentication Group (DAG) MANPRINT Procedures

a. DAGs are sometimes formed to help ensure the validity of operational test data. This DAG process should include all problems affecting players' ability to use, repair, or support the system. Such problems may involve individual or unit performance, human resources, or hazards to personnel and equipment. DAG members determine the nature of MANPRINT problems and their anticipated mission impacts.

(1) The problem statement describes difficult or below-standard human or system performance as described in the MANPRINT Problem Report (Figure 12-3).

(insert Figure 12-3)

(2) Potential impact upon mission accomplishment is based on the MANPRINT Problem Impact Rating Scale presented in Table 12-2.

(insert Table 12-2)

b. The following procedures for the tester help insure that human performance problems are adequately examined before the Test and Evaluation Report (TER) identifies them as such.

(1) Complete the MANPRINT Problem Report as soon as possible after a human performance problem is detected.

(2) Tester's MANPRINT analyst debriefs test participants, data collectors, and other relevant test directorate personnel. The analyst discusses each problem report to confirm the validity of its contents. The analyst then compiles individual

MANPRINT Problem Reports into an overall draft DAG MANPRINT Report. This summary uses the format in Figure 12-4.

(insert Figure 12-4)

(3) Each DAG member independently rates problem severity (Table 12-2). Ratings are then summarized for all DAG members and each problem is assigned the most commonly given rating. Problems are then rank ordered from most through least severe.

(4) This preliminary determination is presented to DAG members to identify any substantial objections to the majority's rating. The rationale for such objections (if any) is heard. The DAG members may, as a group, choose to change the majority's rating. The final version becomes the DAG MANPRINT Report.

Section VIII
Analyzing, Evaluating, and Reporting DT&E Findings

12-17. MANPRINT analyses
The developmental independent evaluator/assessor report their analyzes of MANPRINT issues in the IER/IARs as follows:

a. The human factors engineering, system safety and health hazard, and the manpower, personnel, and training elements of ILS test data from all sources are analyzed to determine conformance to appropriate requirements documents.

b. Any failures to meet the requirements are then assessed/evaluated to determine their cause and their effect on overall mission performance.

c. The test data and analyses elements of the IER/IAR regarding human factors engineering, system safety and health hazard, and the manpower, personnel, and training elements of ILS are reviewed for MANPRINT-related findings and the impact of the problems are summarized in a separate MANPRINT Summary Statement in the IER/IAR.

Section IX
Analyzing, Evaluating, and Reporting OT&E Findings

12-18. Operational evaluator findings
The operational evaluator does the following:

a. Analyze player performance impact on overall system and unit performance.

(1) Analyze player performance measures for impact by procedures, equipment design features, and system operating characteristics.

(2) Analyze player performance measures for sensitivity to individual differences. Examples are aptitude, education, training, and physical characteristics.

(3) Conduct additional analyses of data required to address all MANPRINT MOPs.

b. Evaluate results in terms of MOP findings contributing to criteria which in turn address evaluation issues. Issues impacted by MANPRINT typically involve system efficiency and effectiveness along with health/safety. The evaluation describes and assesses human performance problems which degrade overall system performance.

(1) HFE. System design features failing to accommodate human characteristics and limitations.

(2) Manpower/Organizational.

(a) Personnel demands exceeding resources in applicable TOE.

(b) MOS or CJS, skill levels, and grades inadequate to sustain operations.

(c) Task organization, procedures, and techniques inappropriate for performing required operation, maintenance, and support tasks.

(3) Personnel. MOSs or CJSs for operating, maintaining, and supporting the system that do not possess appropriate and adequate aptitudes.

(4) Training. Critical tasks untrained or inadequately trained.

(5) System safety and health hazards.

(a) Inadequate hazard fixes.

(b) Residual safety and health hazards.

c. Findings are then evaluated to identify potential solutions. These can involve modifications to any or all of the following aspects of human performance.

(1) Hardware and software designs.

(2) Manpower.

(3) Personnel.

(4) Training.

(5) Procedures and techniques.

d. Write and publish the MANPRINT portion of the TER or Operational Assessment (OA).

SMMP REVIEW GUIDE

a. References

(1) AR 602-2 Manpower and Personnel Integration (MANPRINT) in the Materiel Acquisition Process, 19 Apr 1990, as modified by DA Memorandum "MANPRINT Procedural Change: System MANPRINT Management Plan (SMMP) Format Revision," Harold Booher, 27 Sep 1991.

(2) DoD Memorandum "Human Systems Integration Plan Implementation Procedures," Assistant Secretary of Defense, Christopher Jehn, 28 May 91.

b. SMMP Element 1, TITLE PAGE

(1) Was the SMMP approved 60 days prior to each Milestone Decision Review?

c. SMMP Element 2, ABBREVIATED TOTAL SYSTEM DESCRIPTION

(1) Is the operational environment adequately described?

(2) Does the TAD contain all relevant MOSs, including operators, maintainers, and support personnel?

(3) Does the TAD contain sufficient information to assess whether test soldiers are representative of target MOS populations?

d. SMMP Element 3, ACQUISITION STRATEGY

(1) Is the program category and acquisition strategy (developmental, nondevelopmental, materiel change) indicated?

e. SMMP Element 4, PREDECESSOR DEFICIENCIES

(1) Have predecessors for each component of the system been considered, including training devices and repair and support equipment?

Figure 12-1. SMMP Review Guide

(2) If there is no direct predecessor system, have comparable components been considered to construct a notional system for planning purposes?

f. SMMP Element 5, MANPRINT PARAMETERS

(1) Are there any constraints on MOSs or existing force structure?

(2) Has a crew size been previously decided?

(3) Will the system be contractor-supported for the life of the system?

(4) Will there be "package fielding"?

g. Element 6, MANPRINT ISSUES

(1) Are system and human performance issues defined so that they can be operationally tested?

(2) Are system and human performance issues defined so the system and its developers (rather than soldiers manning the system) are held responsible for the achievement of required levels of system performance?

(3) Are task analyses planned? Will findings be available in time to affect system design?

(4) Will Training Effectiveness Analyses (TEA) be available to validate training programs before IOTE?

h. Element 7, MANPRINT EXECUTION

(1) Are task analyses planned?

(2) Are there planned TRADOC test activities (CEP, FDTE, TEA, and EUTE) to answer questions about options for organizations and training programs?

Figure 12-1 SMMP Review Guide (cont'd).

i. Element 8, Annex A, COORDINATION

(1) Have combat, training, and materiel developers been identified?

(2) Has the Logistics Evaluator been identified?

(3) Is the Human Engineering Laboratory (HEL) included?

(4) Is the Surgeon General included?

(5) Is the Army Research Laboratory included?

j. The following DoD requirements also apply to SMMPs.

(1) By Concept Demonstration Approval, does the SMMP address the following MANPRINT aspects of the system?

(a) high drivers and lessons learned from predecessor or comparable system(s)

(b) parameters documented in the ORD included in the Acquisition Program Baseline

(c) exit criteria

(d) TAD for operators and maintainers

(e) impacts accompanying design alternatives

(f) cost, schedule, and design risk identification and management

(g) inclusion in early OT&E during Demonstration and Validation (D&V)

(h) tools, analyses, data bases, and methodologies during D&V

(i) incorporation in acquisition strategy

Figure 12-1 SMMP Review Guide (cont'd).

(2) By Development Approval, does the SMMP address the following MANPRINT aspects of the system?

(a) trade offs made during D&V

(b) early test results influence on design concept

(c) risk management plan

(d) resource adequacy to support the program

(e) criteria to be included in OT&E

(f) source selection criteria impact on suitability

(3) By Production Approval, does the SMMP address the following MANPRINT aspects of the system?

(a) findings from OT&E

(b) scheduling of realistic maintainability demonstrations

(4) By Major Modification Approval, does the SMMP address the following MANPRINT aspects of the system?

(a) opportunities to reduce the cost of ownership

(b) efforts to correct residual health and safety hazards

(c) plans to transition from contractor to organic support (if applicable)

Figure 12-1 SMMP Review Guide (cont'd).

SAMPLE MANPRINT DATA ITEMS

a. Human factors engineering considerations

(1) The nature of required soldier performance on critical tasks [discrete tasks, continuous tasks - tracking/steering, complex tasks - vigilance/reaction, response rates, response modes (hands, eyes, feet, voice, head, torso, etc.), reaction times, completion times, accuracy, error rates and types (omission, commission), interference by elements of task environment]

(2) Equipment/Hardware characteristics

(a) Efficiency of Soldier-Machine Interface [information displays (visual - analog/digital, auditory, tactile, proprioceptive, olfactory), symbology (standard vs. unique), operator controls, speech intelligibility and recognition]

(b) Maintainability [comfort, convenience, portability (bulk, weight, load distribution, straps, handles), accessibility for operation and maintenance, compatibility with soldier characteristics and states, physical workload demands]

(3) Mental workload/information processing demands

(4) Physical workload demands/task overload

(5) Software interface characteristics [video hardware (flicker, glare, contrast ratio, luminance, resolution), screen layout and contents (screen size, partitions, labels, messages, error statements, data entry/display), keyboard characteristics (keystroke feedback, key labeling, keyboard slope, key rollover), system feedback (display update rate, response time, job aids, status information), ergonomics (working level, viewing distance, reach, head position, printer]

Figure 12-2. Sample MANPRINT Data Items

(6) User - system interaction [interference with other systems, training difficulty, error probability and recovery ease, message/data prioritizing, decision and information processing workload]

(7) Task characteristics [task procedures/rules, doctrine, tactics]

(8) Task-interdependence of crew members [independent, parallel, sequential, reciprocal/interactive, communication patterns/information flow, task-interdependence of crews with other organizational elements]

(9) Allocation of system functions (soldiers, hardware, software)

(10) Task environment and workspace [availability/adequacy, dimensions, ingress/egress, mobility, individual clothing, equipment, and weapons, NBC and cold weather protective gear, weather conditions (heat, cold, rain, humidity, ice), ambient light and illumination, air, gases and fumes, pollutants, vibration - frequency, duration, acceleration - magnitude, direction, sign, etc., noise (magnitude, frequency, duration, type {impulse vs. continuous}, physical workspace (individual and crew), stowage (mission gear, personal equipment, emergency equipment), accessibility (operation and maintenance), temperature (monitor and controls)]

(11) Effects of system operation upon soldiers [physical (skills, fatigue), psychological (motivation, morale, satisfaction/frustration, troop acceptance of hardware, software, and task procedures), physiological (hearing, motion sickness), cognitive (learning, knowledge)]

b. Manpower/force structure/organization considerations [numbers of soldiers required to accomplish tasks and missions (gross workload), TOE, MOS, skill level (over-qualified? under-qualified?), grade, skill identifiers, QQPRI/MOS decision, BOIP]

Figure 12-2. Sample MANPRINT Data Items (cont'd)

c. Personnel considerations

(1) Availability projections (TAPA Force Management Book) [MOS structures (Career Management Field), demographic data, individual soldier characteristics]

(2) Target Audience Description (characteristics of target MOS populations)

(3) Test soldier representativeness/typicality

(4) Aptitudes (ASVAB)

(5) Test score categories (AFQT)

(6) Training, skill, experience

(7) Anthropometrics (physical dimensions)

(8) Physical condition/abilities (MEPSCAT)

(9) Medical profile (PULHES)

d. Training considerations

(1) Positive/negative transfer?

(2) Training conditions sufficiently similar to job conditions?

(3) Skill levels adequate for job?

(4) Nonessential skills trained?

(5) Essential skills not trained?

(6) Critical task lists and inventories

(7) Opportunities to practice

(8) Types of training

Figure 12-2. Sample MANPRINT Data Items (cont'd)

(9) Individual/collective

(10) Institutional/unit

(11) Peacetime/mobilization

(12) Skill maintenance and retention/retraining

(13) Transition training

(14) Training courses (length, proponency)

(15) Training hardware/devices/aids

(16) Embedded training

(17) Feedback processes and mechanisms

(18) MOS certification

(19) POI

(20) Technical documentation

(21) ICTP

(22) NET/NETP

(23) TMs

(24) soldier's manuals

(25) SQT

(26) ARTEP

e. Safety and health hazard considerations

(1) Air quality (humidity, temperature, pressure, wind speed, ventilation)

Figure 12-2. Sample MANPRINT Data Items (cont'd)

(2) Pollutants (density of gases, particles, fumes, chemicals, organisms)

(3) Vibration (magnitude, frequency, combined results of multiple sources of vibration)

(4) Acceleration/deceleration (frequency, duration, interval)

(5) Noise (pulse, steady state, frequency, intensity, exposure rate/duration)

(6) Light/Illumination/Lasers (glare, luminance, contrast, frequency, power)

(7) Blast

(8) Electromagnetic Radiation (EMR) hazards

(9) Lightning

(10) Electrostatic Discharge (ESD)/Electromagnetic Interference (EMI)

(11) Electromagnetic Compatibility (EMC)

(12) Electrical/mechanical hazards

(13) Warhead and explosive hazards

(14) Fuels and flammable materials

(15) Gas toxicity

(16) Rough/safe handling

(17) Life support/environmental hazards

(18) Adverse weather conditions (heat, cold, rain, sleet, ice, snow, wind, water, etc.)

Figure 12-2. Sample MANPRINT Data Items (cont'd)

(19) NBC conditions (individual protective measures, hardware component/subsystem protective measures, decontamination procedures, soldier survivability)

(20) Safety release for training and testing

(21) Fatigue

Figure 12-2. Sample MANPRINT Data Items (cont'd)

MANPRINT PROBLEM REPORT

Page 1 of ____ Pages

1. System Name:______ (Twenty digits maximum, name of system under test.)

2. Problem No.______ (Four digits maximum, a number identifying the problem and assigned in the order that the problem occurred during the test. First problem is No. 0001)

3. Variant:__Variant No. 1
__Variant No. 2

__Variant No. nn

(If there is more than one variant to a system each variant is assigned to a 2-digit no. and listed here. A check mark is placed next to the variant to which this Problem Report refers.)

4. Problem Title:___________ (40 digits maximum, short name identifying problem.)

5. Problem Definition:
(A detailed description of the problem, giving all salient points and where possible referring to attached illustrations, photographs and diagrams.)

6. Contributing Causes:

a. (A list of ALL probable causes of the problem.)
b.
.
.
z.

Figure 12-3. MANPRINT Problem Report

MANPRINT PROBLEM REPORT

7. Probable Consequences:

   a. (A list of the PROBABLE implications that the problem has for mission accomplishment, in terms of either direct effects upon system performance or indirect effects upon the system performance due to soldier and death, injury, illness, fatigue, frustration, or boredom.)
   b.
   c.
   .
   .
   z.

8. Potential List of Solutions:

   a. (List as many potential solutions as possible, in order to provide the materiel, combat, and training developers with all feasable options to alleviate the problem. Try to identify solutions that maximize system performance improvements while minimizing the performance burden which is imposed upon soldiers.)
   b.
   c.
   .
   .
   z.

9. Data Source(s):

   a. (List ALL data sources IN DETAIL, e.g., list interview instrument and item number, OTIR number, of where details of observations can be found in the data base. It is absolutely essential to have a clear audit trail to the raw data.)
   b.
   c.
   .
   .
   z.

Figure 12-3. MANPRINT Problem Report (cont'd)

MANPRINT REPORT

PAGE ___ OF ___ PAGES

PROBLEM NO.	PROBLEM TITLE	PROBLEM DEFINITION	CONTRIBUT'G CAUSES	PROBABLE CONSEQUENCE	POTENTION SOLUTIONS	IMPACT RATING	DISSENT VOTES	COMMENTS
001								
002								
nnn								
FOOTNOTE:								

Figure 12-4. DAG MANPRINT Report

TABLE 12-1. MANPRINT EVALUATION DATA BASE

MANPRINT EVALUATION DATA BASE

SYSTEM ABBREVIATION: FILE UPDATED:

SYSTEM NAME:

PREDECESSOR SYSTEM(S):

EVALUATION DIR:

EVALUATOR:

OEC AO: TEXCOM AO:

EVALUATE: ABBREVIATED EVALUATE: NEXT M (0-IV):

NEXT OT: DATES: / / / /

STATUS (R-A-G)	#	ISSUE

TABLE 12-1. MANPRINT EVALUATION DATA BASE
(cont'd)

MANPRINT INDIVIDUAL ISSUES

ISSUE #:
RAG:

SYSTEM:
ISSUE:
MISSION IMPACT (A-E):

SAFETY HAZARD LEVEL (I-IV; A-E):

ISSUE/PROBLEM DESCRIPTION:

SYSTEM COMPONENT:

CONTRIBUTING CAUSE(S):

DESCRIPTION OF MISSION IMPACT:

POTENTIAL SOLUTION:

DATA SOURCES & THEIR DATES:

ACTION(S) REQUIRED:

TIMELINE(S):

RESPONSIBLE AGENCY:

OTP:

TEMP/COIC SECTION(S):

HUC REQUIREMENT(S):

(S):

CRITERION(IA):

MOE:

TABLE 12-2. PROBLEM IMPACT RATING SCALE

PROBLEM IMPACT RATING DATA	
DEGREE OF IMPACT OF THE MANPRINT PROBLEM ON OPERATIONAL MISSION ACCOMPLISHMENT:	
A. SEVERE	The problem has a severe impact on mission and system performance leading to a high probability of mission failure, severe damage or loss of equipment, or severe injury or death to personnel.
B. MAJOR	The problem has a major impact on mission and system performance, leading to a high probability of degraded mission performance, major damage to equipment, or serious injury to personnel.
C. MODERATE	The problem has a moderate impact on system performance, leading to a high probability of degraded mission performance. There may be no measurable impact upon system performance, although there is a measurable impact upon the performance of system components or subsystems (including the human subsystem as soldiers try to compensate for, or work around system defects.
D. MINIMAL	The problem has a minimal impact on system performance. There is no measurable impact on the performance of system components or subsystems (including the human subsystem) although soldiers' negative attitudes toward features of the system may be measurable.
E. NEGLIGIBLE	The problem has a negligible impact on short-term system performance. There may be no measurable impact on soldier's attitudes.

Chapter 13
Threat Considerations in Test and Evaluation

Section I
General

13-1. Introduction
This chapter explains the processes for developing the "threat", integrating it into the T&E planning process, and portraying it in the test. AR 73-1, Test and Evaluation Policy, requires that testing must include an accurate representation of the threat projected to exist at a system post-initial operational capability (IOC) date.

13-2. Threat Provisions in Test
Threats must be identified, approved, and updated continuously throughout the life cycle (AR 381-11). DA-approved (DA DCSINT) threat or system-specific threat definitions developed in accordance with appropriate regulations will be employed when tests are planned, designed,and conducted.

13-3. Threat in the TEMP

a. Representations of threats used for T&E will be approved in accordance with AR 381-11, table 2-1, and identified in the TEMP. Approval for their use will be part of the TEMP coordination and approval process. The TEMP is a key program document which has the primary purpose of describing the necessary DT and OT that relates program schedule, test management structure, and required resources to COIC or exit criteria, critical technical characteristics, required operational characteristics, and evaluation and decision milestones.

b. One aspect of the TEMP relates test events to threat intelligence, as depicted in the STAR/STA, in order to identify requirements for all categories of threat simulators/targets and simulations. DoD Manual 5000.2M requires that threat system and simulator requirements be identified by type, number, and availability in Part V (T&E Resource Summary) of the TEMP. Also required is a comparison with available projected threat systems or simulators and a statement which identifies major shortfalls. Target requirements are to be treated in a similar manner. This data is available to the TIWG/PM through the report prepared by the TAWG during the accreditation of the threat simulators/targets for integration in the TEMP.

13-4. Threat Considerations

Specific threat considerations that must be addressed are described as follows:

a. Testing must accurately represent the threat projected to exist at post-IOC. The post-initial operational capability year established by the operational tester will be used as the basis to determine threat-projection requirements.

b. The threat integrator member of the TIWG will review threat support to testing as part of the Threat Coordinating Group process.

c. If the threat (as described in the STAR), or if any of the threat systems cannot be fully addressed in testing, the limitations, as well as the testers' plan to compensate for the limitations, must be included in the TEMP. The test-threat limitations must be addressed in sufficient detail to provide an understanding of their impact on the test and thereby the impact on providing data and information with which to address the issues and criteria.

d. IER and TER will address the approved threat of the requirements document, as well as the threat projected to exist post-IOC as described in the STAR. IER and TER will separately address each element of the approved threat, as well as the approved threat in existence at the last milestone review, if different.

e. Actual threat systems will be used as targets or simulators during testing. When such threat systems are not available, simulators or threat systems that have been accredited via the Validation and Accreditation Plan for Threat Simulators and Targets will be used. Requirements for threat systems, simulators, and targets are to be coordinated with the PM, ITTS (STRICOM).

f. Test planning must reflect the threat against a supporting system or a system interoperating with the system under test (such as a computer system dependent on a separate communications system).

g. Smoke and obscurants and laser vulnerability will be addressed as a part of all threat considerations for electromagnetic and optical systems.

13-5. Threat Challenge

Meeting this objective, particularly transitioning threat intelligence assessments into instrumented field test arrays adequate to test a developmental system within the context of the operational issues and criteria (OIC), exit criteria, and technical characteristics, is one of the more demanding challenges confronting testers and evaluators. Given resource constraints that preclude representation of a threat force with complete fidelity, testers and evaluators must be persistent and resourceful in seeking means to offset threat portrayal shortfalls to minimize their impacts as potential test limitations with emphasis on those aspects directly related to the OIC.

13-6. Modeling and Simulation of the Threat
Application of modeling and simulation techniques should be considered as a means to offset the impacts of test limitations and assess the impacts of uncertainties that exist in the threat data used in the test.

13-7. Threat Aspects

a. Current and projected military capabilities of a potential enemy to limit, neutralize, or destroy the effectiveness of a mission, organization, or item of equipment under battlefield conditions at a post-IOC date.

b. Intended targets of the U.S. developmental system.

c. Probable enemy reactive threats to the system.

Section II
Derivation of Threat

13-8. Threat intelligence
This term pertains to intelligence that describes the current and projected future capabilities of a potential enemy force against one or more U.S. developmental systems in terms of combat materiel, employment, doctrine, force structure, and combat environment, tailored to support specific combat and materiel development projects. It integrates pertinent data from general, scientific, technical, and estimative intelligence disciplines. Threat intelligence is derived from DA-approved and validated intelligence products which include studies as well as models, simulations, and scenarios. A family of threat documents define, with progressively greater specificity, the threats for developmental systems.

13-9. Military Capabilities Studies (MCS)
These studies replace the Soviet Battlefield Development Plan and will serve as a threat counterpart to the TRADOC Battlefield Development Plan (BDP) and as Army baseline intelligence on various threat forces in support of the Army acquisition process. They are produced by Army Intelligence and Security Command (INSCOM) and Defense Intelligence Agency (DIA) production centers and approved by DA DCSINT/DIA.

13-10. System Threat Assessment Report/System Threat Assessment (STAR/STA)

a. The STAR/STA is the basic threat document supporting system development for both major and nonmajor acquisition programs. It is used to define the threat environment in which a developmental system must function throughout its life cycle, typically at the IOC date plus 10 years.

b. The STAR/STA supports Army Force, Combat, and Material Development. The STAR/STA shall be written, approved, and updated continuously throughout the system development life cycle (DoDD 5000.1).

c. STAR/STA are derived from regional or country MCSs and appropriate Army/DIA scientific and technological intelligence (S&TI) products from the DIA and INSCOM analytical organizations.

d. Although both documents have identical formats, they have differing approval and validation requirements since the STAR is produced to support ACAT I and II and nonmajor programs designated for OSD T&E oversight, while the STA pertains to other nonmajor ACAT III and IV systems.

13-11. Threat Test Support Package (TTSP)

a. The Threat TSP is derived from the STAR/STA, but is more detailed and provides the threat scenarios to support a specific test and assesses the impacts of threat-related test limitations.

b. For ACAT I, ACAT II, and other OSD T&E oversight programs, the Office of the DCSI (ODCSI) will approve the TTSP. The TTSP for all other programs will be approved by the TRADOC Combined Arms Command, Threat Directorate for OT, and the USAMC, ODCSI, for DT. The threat manager for the appropriate TRADOC center or school is the approval authority for the TTSP for CEP.

13-12. Critical Intelligence Parameters (CIP)

a. CIPs serve as a mechanism for determining when an evolving "threat" may impact on the U.S. developmental system.

b. Together, the PM and the AMC senior intelligence officer (SIO) of the proponent centers and commands establish limits defining the degree that threat can change without causing a major redesign or reassessment of the program. These threat limits, expressed as CIPs, define thresholds which, if breached, could change the operational requirement for a system significantly.

c. Once defined, CIPs are submitted through intelligence channels for DA validation. CIPs serve to alert supporting intelligence analysts regarding specific priority intelligence requirements as well as justify subsequent intelligence production efforts and, if needed, supplemental collection actions.

Section III
Targets and Threat Simulators

13-13. Use of Threat Simulators and Targets
Whenever possible, actual threat systems are used during OTE to represent an enemy force, but resource limitations usually result in the use of replicas, threat simulators, and surrogates, the functional characteristics of which approximate those of actual threat systems. Threat simulators generally are more costly and sophisticated than targets and are intended for reuse, while targets are devices which are designed to be engaged and destroyed.

13-14. Program Manager, Instrumentation, Targets, and Threat Simulators (PM, ITTS)
The PM, ITTS, a subordinate of STRICOM, is responsible for the engineering, development, acquisition, fielding and capability accounting of Army targets, threat simulators, and major range instrumentation for DT and OT. It is the executive agent for both the ATS and Army Targets Programs.

13-15. ATS Program
With transfer of US Army Missile and Space Intelligence Center (MSIC) from the former Army Intelligence Agency to DIA and the transfer of the Threat Simulator Management Office (formerly Threat Simulator Project Office) from MSIC to PM, ITTS, the latter organization became the materiel developer for the ATS Program. The Threat Simulator Management Office (TSMO) plans,

organizes, directs, and manages the ATS Program. The Army FSTC, supports TSMO in developing nonmissile-related threat simulators.

13-16. Army Target Program
Targets Management Office (TMO), upon transfer from MICOM to PM, ITTS became the materiel developer for Army ground and aerial targets for use in DT and OT.

13-17. Threat Simulator and Target Validation

a. Validation is the process used to determine whether a simulator or target provides a sufficiently realistic representation of a corresponding threat system to justify continuation of its development, use, or modification to restore or improve its capabilities to conform with current intelligence estimates.

b. Under provisions of the U.S. Army Validation and Accreditation Plan for Threat Simulators and Targets, validation working groups (VWG), comprised of representatives of user, intelligence, and simulator/target development organizations are convened by TEMA, which charters them and designates the chairman (normally an analyst from the appropriate S&TI production center). PM, ITTS determines when VWGs are required, informs TEMA, and also participates in the meetings.

c. Validation is performed at key decision points during the life cycle of simulator or target: Design specification review; critical design review; IOC (acceptance); and operational (upon major modification and periodically following acceptance for use in testing.

d. The DoD Executive Committee on Threat Simulators is notified of all VWG actions and it must approve the design specification review results prior to the award of a contract to develop a simulator and the results of acceptance VWG before the simulator can be used in testing.

13-18. Technical and Use Analyses
During validation, a technical analysis (a comparison of simulator capabilities with current S&TI) and a use analysis (a comparison of simulator capabilities and limitations with the projected general use or known requirements) are evaluated to determine the validity for its intended role in testing.

13-19. Foreign Materiel Program (FMP)
DA DCSINT has overall Army staff responsibility for the FMP for the acquisition and exploitation of foreign materiel, which is a

source of actual equipment for use in testing developmental U.S. systems. The acquisition and exploitation functions are executed by INSCOM, and FSTC, respectively.

13-20. OPTEC Threat Support Activity (OTSA)
OTSA operates and maintains the threat simulators in its inventory in support of Service testing and training activities. It assists in test planning, and participates in VWGs, threat accreditation working groups, and OTRR.

Section IV
Threat Support to Force, Combat, and Materiel Development

13-21. Guidance (AR 381-11)

a. As the principal source of guidance for threat intelligence support, AR 381-11 reaffirms the guidance in DoD Instruction 5000.2 that the objective of threat support is to ensure that each system developed is mission capable in its intended operational environment throughout its expected operational life.

b. DA DCSINT is an approval/validation authority for threat documents produced by combat developers and materiel developers, to support acquisition programs for materiel systems and ensures that approved threat is used in testing.

c. Threat to be portrayed in testing for major programs (ACAT I and II) and nonmajor (ACAT III and IV) programs designated for OSD T&E oversight, must be based on DIA validated threat data sources and is subject to DIA guidance, review, or validation. For other ACAT III and IV programs, the appropriate MACOM is responsible for coordinating the preparation of threat assessments and threat test support documentation.

d. TRADOC is the principal combat developer for material systems and tactical automated information systems (AIS) with INSCOM, Hospital Service Command, Medical Research Command, Corps of Engineers, Criminal Investigation Command, and the Army Strategic Defense Command also designated by AR 70-1 as combat developers for specialized materiel.

e. AMC is the principal materiel developer for materiel systems. The Information Systems Command has both combat and materiel developer responsibilities for sustaining base and strategic automated information systems.

f. These MACOMs prepare and approve the threat inputs for program management documents and, when required to support testing, the necessary threat documentation as well as validating threat portrayals.

13-22. Program Management Documents
The threat portions of system programmatic documents for major programs and nonmajor programs designated for OSD T&E oversight are prepared by the AMC DCSINT and TRADOC Combined Arms Command (CAC) Threat Directorate (TD), working cooperatively. These include the MNS, ORD, integrated program summary (IPS), and COEA, which support the decision to enter EMD for the system. These threats are validated by DA DCSINT. For other nonmajor programs, CAC/TD and AMC DCSINT prepare and approve the threat portions of these programmatic documents.

13-23. Test Support Documents
Because a number of organizations share responsibility for the complex and demanding task of integrating threat into T&E, the major provisions of AR 381-11 and related regulations (TRADOC Regulation 381-1 and Pamphlet 381-3) should be consulted for detailed explanations of organizational responsibilities with respect to threat support. The process of integrating threat into T&E programs requires that DCSOPS, DCSINT, AMC, TRADOC, TECOM, AMSAA, and OPTEC coordinate closely and constantly throughout the acquisition process.

Section V
Required Characteristics of Threat Support to T&E

13-24. Consistency
The threat environments applied to testing of developmental systems must be derived from a baseline of DA-approved intelligence products. Threat portrayals for DT and OT of a system, while tailored for each test, must remain compatible throughout testing.

13-25. Continuity
The planned portrayal of threat must be evaluated at each phase in the T&E cycle to ensure that related shortfalls are identified in T&E documents as test limitations and their impacts on the validity of the test are assessed. Efforts to incorporate the most current threat intelligence in test planning and to upgrade the fidelity of planned threat portrayals must be continuous.

13-26. Timeliness

Intelligence estimates of the threat, even though they may treat specific aspects of future threat forces capabilities with uncertainty due to intelligence "gaps", must be provided to developers and testers, on a timely basis, to meet prescribed planning milestones throughout the T&E cycle.

13-27. Tailored
Threat must be tailored to each test to ensure that the simulated battlefield environment is adequate to test the developmental system in the context of the OIC it must satisfy. In defining the threat for developers, testers, and evaluators, implications of incomplete intelligence must be identified to them in terms of "gaps" and uncertainties to allow early consideration of the application of automated modeling and simulation techniques necessary to integrate relevant threat intelligence uncertainties into T&E processes.

13-28. Comprehensiveness
The threat against the total system must be described and include supporting systems or other interoperating systems, such as a computer system dependent on a separate communications system.

Section VI
Management of the Threat during Test Planning

13-29. Planning Overview
Operational testers and evaluators are expected to understand the evolving threat and integrate it into operational tests that address COIC or exit criteria, AOIC, or technical characteristics and are realistic, representative, and credible. Threat-related issues should be managed using the following guidelines:

13-30. Planning Coordination for OT

a. Coordination between testers and evaluators with the appropriate MACOM threat support organization (usually the TRADOC center or school threat manager) responsible for the production of the STAR/STA and TTSP should be established early and continue throughout test planning.

b. In addition to approved COIC or exit criteria, the supporting threat organization must have access to the AOIC and the planning data embodied in the operational test design concept (OTDC) in Chapter 2 of the test and evaluation plan (TEP). The OTDC includes the scope (tactical scenarios, degree of operational realism, and types of test events), test factors and

conditions (control of factors to ensure test events occur under appropriate combinations of test conditions), and test design matrices (grouping of test conditions into trials, vignettes, missions, and phases).

c. Since the TTSP supports preparation of the test design plan and must be prepared to meet regulation-specified OTE planning timelines, the supporting threat organization must receive OTDC data as early as possible (see Part V on OTE planning processes).

13-31. Review of Threat Documents
Threat documents, the STAR/STA, its updates, and TTSP, are of concern to the evaluator, who is responsible to review them for adequacy and to ensure they have been approved and validated IAW Table 2-1, AR 381-11, before use.

13-32. Ad-hoc Intelligence Integrating Working Groups

a. Figure 13-1 is a simplified schematic of the relationship of supporting threat intelligence documents and the OTE process. The chart illustrates that the flow of threat support is a complex process with multiple layers of review for approval and validation and there are few interfaces between threat support and T&E processes. Consequently, testers and evaluators must actively participate in several "ad-hoc" intelligence working groups for integrating the threat support provided to T&E and test readiness reviews to ensure the readiness of plans and resources, which includes those related to the threat.

(INSERT FIGURE 13-1)

b. DA DCSINT designates a threat integration staff officer (TISO) for specific mission areas to coordinate closely with representatives of the HQ DA staff, combat and materiel developers, OPTEC, program executive offices (PEO) and the Army intelligence community to assure responsive threat support and guidance throughout the life cycle of a program. The TISO accomplishes much of this coordination through "ad hoc" threat integrating bodies.

13-33. System-Specific Threat Coordinating Group (TCG)
The threat integrator member of the TIWG will establish and chair a TCG as a subgroup of the TIWG. For major and designated nonmajor materiel programs, this will be accomplished by the DA DCSINT TISO, while the TRADOC TM/AMC FIO, as appropriate, has this responsibility for other nonmajor programs. The TCG includes representatives from TRADOC CAC/TD, the center or

school TM, AMC DCSINT, OPTEC (tester and evaluator), and the DIA and INSCOM intelligence producing organizations (as required). The TCG operates throughout the life cycle of the developmental system. The System-Specific TCG performs the following functions:

a. Coordinate the production and approval/validation of threat intelligence in support of Army developmental systems.

b. Review and coordinate approval of STARs and TTSPs and threat portions of system program management documents.

c. Review combat simulations and models and intelligence data for correct threat applications.

d. Review and coordinate threat support to testing to include scenarios and use of simulators, surrogates, and targets.

e. Assist combat and materiel developers to identify and articulate their intelligence requirements, to include those responding to CIP requirements, and facilitate preparation of appropriate production tasking for the intelligence community.

f. Identify threat and/or threat support issues and determine responsibility for resolution.

13-34. Threat Accreditation Working Group (TAWG)
Under provisions of the U.S. Army Validation and Accreditation Plan for Threat Simulators and Targets, the TAWG operates to approve these resources for specific test applications. Included in its membership are representatives from the same organizations that comprise the TCG as well as the PM ITTS, threat simulator and target materiel developer offices, appropriate S&TI center analyst(s), and the system program manager. The TAWG should meet at least 24 months prior to the test (T-720) to accomplish the following functions:

a. Accredit the use of designated threat simulators/ targets for each test.

b. Ensure that threat resources in the final outline test plan (OTP) are adequate to represent the threat prior to submission to the Test Schedule and Review Committee (TSARC).

c. Identify differences ("deltas") between the simulators or targets and current estimates of corresponding threat system characteristics and assess their impacts on the test.

d. Through comparison of the drafts of the TTSP and Chapter 2 of the TEP, accreditation offers a timely opportunity to reconcile differences between them. Also, this facilitates development of test planning guidance as a basis to complete Chapter 3 of the TEP and provide increased assurance that the threat resources identified in the OTP will be sufficient to represent the threat with greater fidelity during the test.

13-35. Operational Test Readiness Reviews (OTRR)
TRADOC CAC/TD is responsible to validate the planned threat portrayal. For force-on-force tests, it also validates the threat force training plan prepared by the TM. This validation is documented in the Operational Test Readiness Statement (OTRS) prepared by the combat developer. OTSA also participates to report of the preparedness of threat simulators.

13-36. Management of Threat-Portrayal Shortfalls
Testers and evaluators, through coordination and active participation in the TCG and TAWG will be able to identify potential threat portrayal shortfalls in early in T&E planning.

13-37. Deviations From the Threat
When significant deviations from the validated threat are expected in test portrayals, whether due to a lack of threat resources or situations dictated by testing requirements and/or it is determined that potential portrayal shortfalls pose significant risks to test validity, the appropriate TM and threat integration center (usually CAC/TD) should be consulted so they can seek, "offsets" or alternatives to minimize potential threat-related test limitations. If necessary, CAC/TD can seek formal DA DCSINT TISO recommendations for alternative solutions to permit early resolution of problems by OTE decision makers.

13-38. Threat Uncertainties
When significant uncertainties exist in supporting threat intelligence, or there are significant threat portrayal shortfalls, the use of modeling and simulation techniques as a means of compensating for these limitations should be considered.

Section VII
Management of On-Site Threat Portrayal Issues

13-39. Threat Portrayal Fidelity

a. Due to resource limitations, it is unlikely that the threat force in a test will be represented with total fidelity to

the threat as described in the STAR and specifically defined for the test in the TTSP. The degree to which threat force operations will be faithfully represented during the test will be based on subjective judgements of those who witness it.

b. For T&E purposes, the true criteria for this judgement is the adequacy of the threat portrayed to support realistic testing of the developmental system within the context of the COIC or exit criteria and AOIC it must satisfy rather than a strict comparison of the portrayed threat point-by-point against the "text book".

13-40. Threat Critiques
Intelligence personnel supporting or observing test preparations and/or execution should direct commentary or critiques on the threat portrayal through the evaluator. This will ensure that only those comments deemed relevant to the interpretation and evaluation of test results are communicated to other personnel directly associated with the test.

13-41. Resolution of Threat Shortfalls
Normally, the TRADOC center or school TM, who is responsible for the STAR/STA and TTSP and assisting in setting-up the test and overseeing its threat-related aspects, and the CAC/TD, the Army validating authority for threat portrayals, will be on-site and are capable of interpreting the significance of threat-related issues on test validity, thereby minimizing the potential for controversy.

13-42. Threat Limitations on Test
Significant portrayal shortfalls must be included in OTE reports as "test limitations" and their impact on test validity assessed in test and evaluation reports.

Section VIII
Threat Integration in Test Planning

13-43. Significance of Threat for T&E
The "threat" is an essential test element which is difficult to represent and typically has the greatest impact on the overall results. Testers and evaluators are required to identify the appropriate threat from the STAR/STA, the means for replicating that threat in testing, and the methods for quantifying its effect on the test and the system.

13-44. Threat Challenges

a. OTE is based on COIC developed early in the program and AOIC, which provide testable criteria to support evaluation of a related COIC, that must be answered to support a production decision. Answers to many of these OIC are "threat sensitive"; that is, they depend heavily on the threat environment to which the system is subjected in testing.

b. The challenge confronting testers and evaluators is to ensure that the threat is current, realistic, and sufficiently stressful to adequately test the system against the COIC or exit criteria it must satisfy and that it is faithfully replicated in the test. Several factors complicate these tasks:

13-45. Threat is Dynamic and Uncertain

The "threat" to be portrayed in testing results from an intelligence estimative analytical process which assesses specific military capabilities of a potential enemy usually at future points in time. Although "uncertainty" is inherent in all intelligence, estimative intelligence, due to the limited availability of collectable information, to a greater degree than other types of analytical disciplines, is heavily reliant on applied methodologies usually derived from the physical sciences. As new intelligence is developed and intelligence "gaps" narrow or close as a result of supplemental collection and analysis or evolving methodologies, the threat may change. If the DA threat coordinating group determines these changes to be substantial, they must be incorporated into T&E activities.

13-46. Threat Inconsistency

The COIC, defining acceptable standards of system performance, are formulated before the STAR/STA. As a result, there may be differences between the threat outlined in the STAR/STA and the threat considered in developing the COIC/AOIC. The situation also can arise with the TTSP which may require modification to accommodate evolving OIC or exit criteria and test planning.

13-47. Threat Scenarios

a. Defense Guidance (DG). The annual DG, issued by the Secretary of Defense, provides a set of common planning assumptions for U.S. and friendly forces and planning scenarios projected for a ten-year period. It also defines strategy and force options identifying the specific operational environments in which U.S. forces must be prepared to function. The DG is also the basis for development of U.S. Army scenarios to support the force and materiel development processes.

b. TRADOC Standard Scenarios. The purpose of a standard

scenario is to provide consistency and reduce bias for all combat development programs through use of a common base case that portrays TRADOC-approved U.S. Army doctrinal and operational concepts. The TRADOC Analysis Command is the proponent for scenario development for friendly forces, while TRADOC CAC/TD assists in preparation of the threat force scenario, which is validated by DA DCSINT. TRADOC standard scenarios are considered in the development of threat force scenarios in the Threat TSP and preparation of the Integrated Threat Tactical Operations Plan, both of which support the test design process. During OTP preparation/preliminary test design planning, the system proponent and the operational tester, subject to TIWG approval, select the standard scenario for use in testing. Both friendly and threat test operations must be compatible with the selected standard scenario.

c. Integrated Threat Tactical Operations Plan (ITTOP). The ITTOP is an instructional guide for the operation of simulators also useful in test planning, specifically as a reference in preparing both Chapter 3 of the TEP and the detailed test plan (DTP). It is produced by OTSA, approved by OPTEC, and validated by DA.

Section IX
Relationship of Threat Documents to OTE

13-48. General Relationships
The STAR/STA as used in support of OTE defines the threat environment in which an emerging system must function throughout its life cycle, while the TTSP expands the content of the STAR/STA in sufficient detail for use in defining the environment necessary to plan and conduct the OT.

13-49. STAR/STA Preparation

a. Purpose.

(1) The STAR/STA is the basic authoritative system threat assessment tailored for and focused on a specific defense acquisition program. It is used as a basis to the prepare the threat portions of system programmatic documents to include the IPS, ORD, and COEA, which support the decision to enter EMD.

(2) For OTE, the STAR/STA, is used to define the "tactical context" to support development of the TEMP, outline test plan (OTP), and Chapters 1 and 2 of the TEP.

b. Preparation and Approval.

(1) Preparation of the initial STAR/STA by the CBTDEV, usually the TRADOC proponent school TM, in coordination with materiel developer, normally the AMC proponent FIO, commences upon program initiation with approval of the MNS.

(2) For most major programs and nonmajor programs designated for OSD T&E oversight, the STAR is reviewed and approved by TRADOC CAC/TD and AMC DCSINT and forwarded to DA DCSINT for validation within 150 days after MDR 0.

(3) Most STA for nonmajor programs are jointly validated by TRADOC CAC/TD and AMC DCSINT. AMC normally prepares STAR/STA updates for subsequent MDRs. The DIA validates STAR used for MDRs, or when validation is requested by DA DCSINT.

(4) Per DoD Manual 5000.2M, preparation of the STAR/STA for systems which are not threat dependent may be waived, upon request, by the appropriate milestone decision authority.

c. Content and Format. STAR/STA format and content are detailed in DoD Manual 5000.2-M, AR 381-11, Appendix C of TRADOC Pamphlet 381-3, and outlined in Figure 13-2.

(INSERT FIGURE 13-2)

d. Criteria for Use. Before use in T&E planning the STAR/STA must be approved and validated IAW AR 381-11, Table 2-1.

13-50. TTSP

a. Purpose.

(1) Derived from the STAR/STA, the TTSP is more detailed and is used in developing the "OTE environment" necessary to prepare Chapter 3 of the TEP and provides the threat scenarios for each user test. Determination of the threat year and scenario selection for the test will be made by the TIWG upon the recommendation of the system proponent and the evaluation organization.

(2) The TTSP defines the threat portion of a realistic operational test environment adequate to test and evaluate the developmental system in the context of related COIC or exit criteria and AOIC.

b. Preparation and Approval.

(1) For OTE, the CBTDEV, normally the TRADOC proponent center/school TM, prepares the TTSP for each IOT, 18 months (T-540) before the test start date. For other tests (FDTE, EUTE, LUT, or FOT, a TTSP will be prepared unless the TIWG, acting upon the recommendation of the evaluation organization, determines that a validated threat portrayal is not required for the test. The requirements of the OIC, OTDC, and TEMP will form the basis for a recommendation to waive the TTSP. For DT no TTSP is prepared unless threat force operations are to be portrayed.

(2) For user testing of tactical systems, the threat integration center, usually the CAC/TD, approves/validates the TTSP, from a "tester's perspective", to ensure that threat operations are portrayed accurately and consistently. DA DCSINT is the validation authority for TTSPs for ACAT I and II and ACAT III and IV materiel programs on the OSD T&E oversight list and provides a copy to DIA for review and comment. Most TTSP for user testing of other nonmajor systems are approved and validated by the TRADOC CAC/TD, while this is done by appropriate AMC FIO, when a TTSP is required to support DT. TTSP must be approved and validated 14 months before the test date (T-420).

c. Content and Format. TTSP format and content are detailed in Appendix C, AR 381-11, TRADOC Pamphlet 381-3, and outlined in Figure 13-3. It is prepared in modular format to facilitate the updating process from test to test since only those parts required for a given test need to be completed. Section III (Threat) often requires revision, since the AOIC and the TEP continue to evolve.

(INSERT FIGURE 13-3)

d. Criteria for use. The TTSP must accurately reflect the threat assessment embodied in the STAR and be validated/ approved IAW Table 2-1, AR 381-11. The appendices of the TTSP are closely aligned to elements of the TEP for the OT. These relationships are shown in Figure 13-4.

(INSERT FIGURE 13-4)

Section X
Integration of Threat Data in OT Planning

13-51. Threat and Evaluation MOE and MOP
Although the evaluator has access to threat intelligence (STAR/STA) shortly after program initiation that is used to

define the "tactical context" for the test, actual integration of the threat into OTE does not begin until after completion of the functional dendritics, which do not consider the threat. The dendritics for each system are used to define system functions and subfunctions, clarify primary measures of effectiveness (derived from the COIC), and formulate measures of performance and data requirements necessary for OTE.

13-52. Threat and Test Factors and Conditions
Threat, however, becomes operative as the evaluator endeavors to identify factors (test variables likely to effect test event outcomes) and the conditions (discrete aspects of a factor, or factors, often expressed as a range of values, capabilities, or operational modes). Threat data, such as the types and echelon of forces, types and numbers of systems, and doctrine and tactics, which determine threat force movements and operations under varying situations, become factors and conditions for purposes of developing a test concept. Once these determinations are made, usually through use of a matrix approach keyed to each operational issue and associated criteria, the evaluator then must decide how each factor and condition, including those related to the threat, will be controlled during testing, i.e., "fixed", "systematically varied", "tactically varied", or "uncontrolled" (See Part 5).

13-53. Threat and the Tactical Context
The STAR/STA is used to define the tactical context describing the threat environment and threat systems that will exist at the IOC date and throughout the life cycle of the developmental system. The evaluator uses the STAR/STA to identify the tactical setting as well as develop the factors and conditions to formulate the "test approach" section of Chapter 2 of the TEP for use of the tester to prepare Chapter 3, the test design plan. The evaluator should make this same information available to the appropriate threat support office, usually the TRADOC center/school TM, as early as possible, in order to expedite preparation of the Threat TSP, which is essential to development of Chapter 3. As the tester refines the OTDC or "test approach" guidance developed by the evaluator, must continue coordination with the TM to ensure timely completion of a Threat TSP tailored to test requirements.

13-54. Threat and the OTE Environment
In contrast to the tactical context, the OTE environment, or the combat situations in which the system will be tested at a post-IOC time usually selected by the tester, is derived from the OTDC, test design plan, and TTSP. Relationships between systems and factors that enhance and diminish operational effectiveness,

in terms of the tactical context and the OTE environment, are illustrated by Figure 13-5. Both enhancing and diminishing factors are included in the OTE environment. Measuring the cumulative effects of these factors on system operational effectiveness is a primary objective of OT.

(INSERT FIGURE 13-5)

a. Enhancing Factors. The organization, tactics, and doctrine of employment are integrated so that operational effectiveness of the system is enhanced.

b. Diminishing Factors. At the same time, the operational effectiveness of a system is subjected to diminishing factors. The chief diminishing factor standing between the system and the achievement of its mission is the enemy, i.e., the threat. Others factors include the effects of weather, terrain, and interference from other systems.

13-55. Test Profile Sets
TTSP contain threat profiles, system profiles, and environmental profiles. Test designers merge threat, system, and environmental profiles into "test profile sets," which are incorporated into chapter 3 of the TEP (test design plan). The relationships among test threat, system, and environmental profiles in test profile sets are illustrated in Figure 13-6.

(INSERT FIGURE 13-6)

13-56. Threat Profiles
The TTSP contains individual test threat profiles consistent with the overall test objectives, scenarios, and threat resources to be used. Threat profiles describe the types of threat and threat equipment that the system is likely to encounter, specific threat effects anticipated, threat tactics and countermeasures, threat doctrine and employment practices, and threat organizations. The operational tester uses the threat profiles to develop the OTE environment and the target arrays for the test.

13-57. Scoping of Test Profiles
Because the number of possible test profile sets is so large and COIC can be resolved through analytical means other than OTE, it is neither economical nor desirable to develop threat profiles for every possible profile set. Therefore, the tester must monitor the preparation of the TTSP closely to ensure that:

a. Threat profiles are configured appropriately for the environmental conditions and means of employment (tactics,

doctrine, and organization) most of which are important in order to respond to the test issues.

b. Threat profiles are developed only for those aspects of a threat profile that are technically possible, operationally feasible, and realistic.

13-58. Profile Complexity

Because the TTSP becomes progressively more complex during the system development process, test threat profiles also increase correspondingly in scope and complexity.

a. For EUTE, the test threat profiles focus on potential targets, countermeasures, and opposing weapons at the single system one-on-one level.

b. For IOTE, the test threat profiles, depending on the developmental system, can expand to include opposing forces up to the battalion level.

c. At FOTE, the test threat profiles include an updated configuration of potential opposing forces at all levels.

13-59. System Profiles

System profiles define the tactical applications of the friendly system as derived from the STAR (U.S. system description section provided by the combat developer). See Figure 13-6.

13-60. Environmental Profiles

These profiles define the terrain, weather, communications, and transportation infrastructures, friendly interference (e.g., radio frequency), time and distance separating operating forces from their support structure, and other non-threat conditions under which the test is to be conducted. The test environmental profiles are drawn from the system requirements documents and supporting analyses. See Figure 13-6.

13-61. Lethality and Survivability

a. Direct Effect Systems. For those kinetic, chemical, and directed-energy weapons which have direct impacts against the threat force, effectiveness is measured in terms of lethality and survivability.

b. Indirect Effect Systems. Other types of systems are designed to operate indirectly against threat systems by enhancing the lethality and/or survivability of a primary system, e.g., improving the mobility, C3, or intelligence support of a

lethal system. While the operational effectiveness of indirect systems cannot be measured by the direct impact they have on the threat force, they can be measured by the extent to which they either multiply the lethality, or increase the survivability, of a primary (direct effect) system.

c. Combined Effect Systems. Some indirect systems and subsystems, i.e., communications and target acquisition, however, are subject to both lethal and nonlethal EW threats. Although EUTE may isolate and emphasize the EW threats against indirect systems, ultimately a determination must be made whether the indirect system measurably contributes to the operational effectiveness of either specific lethal systems or combat forces overall. These determinations are difficult and tenuous if indirect systems, such as intelligence systems, are evaluated against the threat of deception, or if EW systems are measured against enemy communications.

13-62. Threat Adequacy

a. The OIC may require measurement of the combined impact of the factors that enhance and diminish operational effectiveness on lethality and survivability or the multiplying effect of one system on the lethality and survivability of another system. When either circumstance exists, the operational tester and evaluator must ensure that the threat portrayed in the test will be sufficient to support evaluation of direct effect system as well as the impacts of indirect effect systems.

b. Lacking an adequate threat portrayal that considers both types of systems, the evaluator will be unable to make accurate assessments of system operational effectiveness. Figure 13-7 illustrates the relationship among these factors and shows the importance of the tactical context and test environment in determining the operational effectiveness of a system in terms of its lethality and survivability in the presence of a threat force.

(INSERT FIGURE 13-7)

SECTION XI
Threat and Modeling and Simulation

13-63. Applications
Modeling/simulation (M/S) can be a valuable adjunct to testing to

provide data when actual field testing is either infeasible or impractical due to factors of cost; test time; unsuitability of maneuver space, terrain, or weather; security considerations; safety; threat portrayal shortfalls; restriction on use of the electromagnetic spectrum; and limited instrumentation other test resources. The determination to employ simulations techniques can be based on threat considerations such as the following:

a. Threat-related resource limitations. Estimated threat capabilities cannot be adequately represented due to a lack of threat simulators/targets and/or threat surrogates which match estimated threat capabilities.

b. Uncertainties and variables. Modeling and simulation techniques have considerable potential for improving the fidelity of the portrayal of threat in OTE activities. There are significant uncertainties related to the estimates of future threat capabilities which should be carefully considered in all OTE activities. Sensitivity analyses, using M/S techniques, can be applied to examine the impacts of incomplete or uncertain estimative intelligence on testing. In addition, M/S can assist in projecting the implications of future enemy reactive threat to the system being tested. Typical aspects of the threat that lend themselves to M/S techniques include:

(1) System performance characteristics, for which Army S&TI production agencies develop "best estimates", that normally become the basis for OTE field testing design, as well as high and low parametric values as a means of "bounding" the uncertainties.

(2) Variables related to evolving threat forces as a result of materiel upgrades, organizational changes, and modifications of doctrine and tactics.

(3) Scenario-related operational options involving the types of combat operations being portrayed, e.g., main attack versus supporting attacks, or offense versus defense.

c. Pretest M/S applications.

(1) Test planning. An important use of M/S techniques in test planning is the refinement of test scenarios and data matrices to decide which elements of system performance should be the focus of OTE. To do this, the modeling and simulations used must relate the operational effectiveness and suitability of the system in a realistic scenario, with appropriate force levels using situations identified in the operational mode summary/

mission profile (OMS/MP). This allows the evaluator to do sensitivity, contingency, and functional analyses for various technical and force mix assumptions.

(2) Determine "deltas". There is a perceived need in designing tests to compare (or determine the differences or "deltas") between the performance of threat simulators/targets deployed in the test array and evolving intelligence estimates of the characteristics and capabilities of the actual threat system(s).

13-64. Model-Test-Model (MTM) Concept

a. Purpose. In the context of the MTM concept, M/S techniques augment field test results to accomplish one or more of the following general purposes:

(1) Extrapolation or expansion of the results of reduced-scale field testing to determine the outcome/impacts on larger forces.

(2) Extrapolation of test results across differing scenarios, terrain, and environments and extend test results in time.

(3) Comparison of multiple repetitions of test events.

(4) Conduct sensitivity analyses to address a myriad of "what if" questions some of which relate to threat variables.

b. The process.

(1) Step 1. Use of a combat model to refine test design, check execution timing, plan location of support equipment, and predict field test outcome.

(2) Step 2. Execute the field test and then calibrate the model with test results.

(3) Step 3. Use model to augment field test results for one or more of the purposes listed above.

13-65. Threat Support to MTM
Although there are rigorous verification, validation, and accreditation procedures for the application of M/S techniques in OTE, an essential prerequisite for their use is a process to ensure that threat representations and usage modeled or simulated are consistent with approved estimative intelligence through Army and Defense Intelligence Agency validation (See chapter 16,

Modeling and Simulation in Support of Test and Evaluation).

a. Approval/validation of threat data. The threat represented in the model must be documented and traceable to an approved and validated STAR and Threat TSP, or to automated threat data from other approved Army high- and low-resolution models. The threat portions of M/S developed by TRADOC are approved by CAC/TD and validated by DA DCSINT. Threat data to be used in M/S applications, however, is validated by CAC/TD. Deviations from threat data contained in DA DCSINT and DIA approved intelligence; however, must be fully documented and approved by DA DCSINT before use.

b. Threat requirements for sensitivity analyses. If M/S is appropriate to conduct sensitivity analyses related to uncertainties in the "threat", the evaluator will require a range of threat alternatives or variables, e.g., threat force weapons and systems parameters and/or doctrinal, organizational, or operational options derived by intelligence analysts.

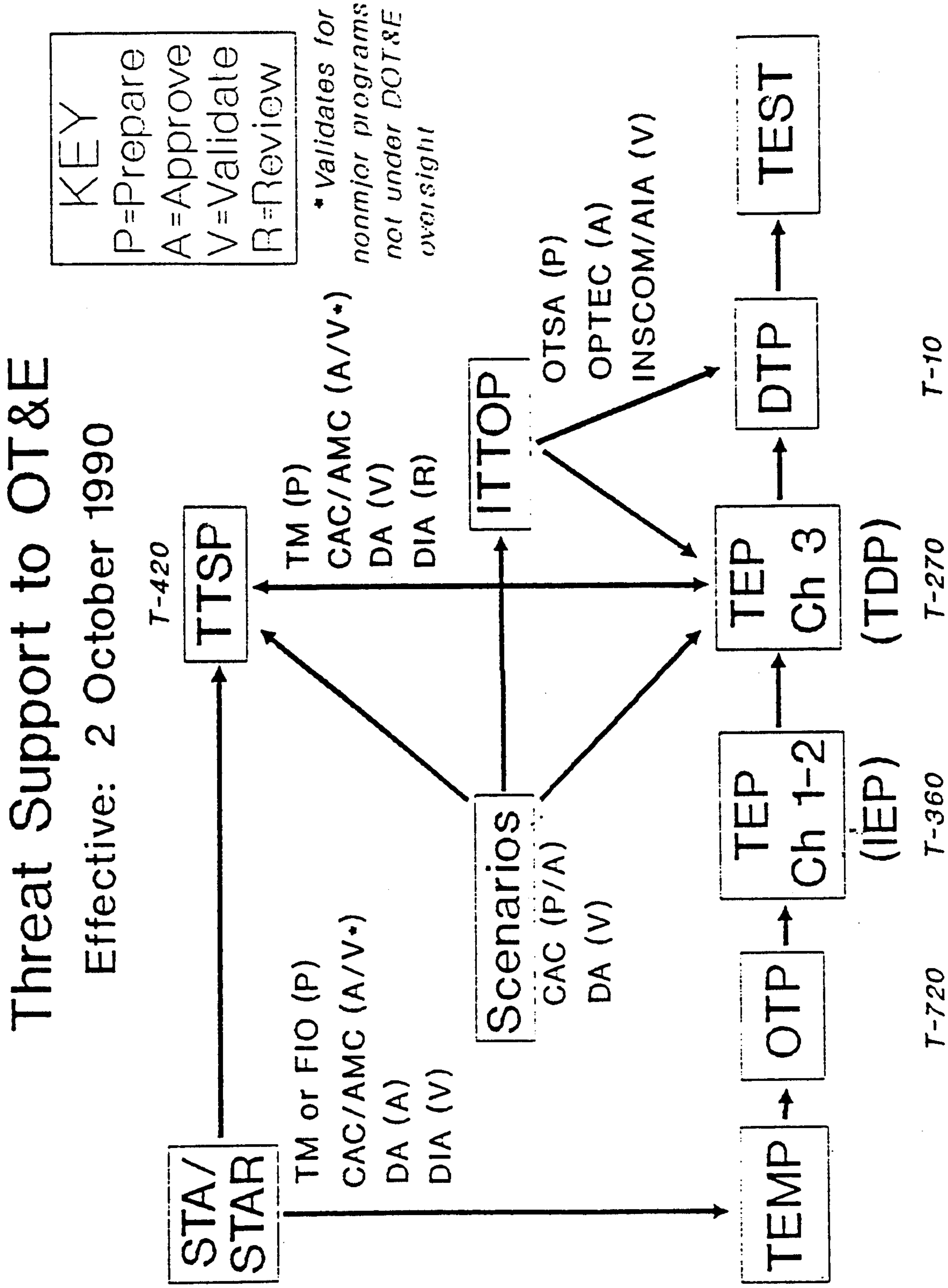


Figure 13-1. Relationship of threat support documentation and operational testing and evaluation for tactical systems.

Title page, tables of contents, and executive summary.

Body.

Chapter 1. Introduction. (Synopsis of MNS).

Chapter 2. U.S. system description. (Derived from ORD).

Chapter 3. Operational threat environment. (General overview of the operational, physical, and technological environment in which the system will function during its life cycle (IOC + 10 years).

Chapter 4. Targets. (Analysis of actual capabilities and signatures of the enemy targets to be engaged by U.S. system, if needed).

Chapter 5. System specific threat. (Integrates force levels, weapons, and doctrine & tactics against tested system by region or country).

Chapter 6. Reactive threat. (Probable reaction from introduction of the U.S. system.)

Appendix A. Critical intelligence parameters.

Appendix B. Appropriate tables, drawings, or charts.

Appendix C. Bibliography.

Appendix D. Distribution.

Figure 13-2. Format of the STAR/STA.

Title page & tables of contents.

Body.

Section I. Background information.
- (1) Description of system to be tested.
- (2) Type of test.
- (3) Evaluating organization.
- (4) Test organization.
- (5) TRADOC proponent school.
- (6) Test dates.
- (7) Test location.
- (8) Simulated location.
- (9) IOC of tested system.
- (10) Threat year.

Section II. Issues & Criteria.

Section III. Threat.

- (1) Specific systems & units that are a threat to, or a target of, the system.
- (2) Threat tactics, doctrine, techniques, and procedures, and flight profiles, as appropriate.
- (3) Threat countermeasures.

Section IV. Test-specific appendices:
- Appendix A. Test concept.
- Appendix B. Scenario.
- Appendix C. Description of trials/test runs/vignettes.
- Appendix D. Firer/target matrix.
- Appendix E. Target, threat simulator, and surrogate equipment.
- Appendix F. Limitations.
- Appendix G. Threat force training plan (if force-on-force).

Figure 13-3. Format of the Threat TSP.

CORRESPONDANCES BETWEEN TTSP APPENDICES AND THE TEP

Appendix A. Test concept. The tester prepares the test concept (section 3.1 of the TEP) based on Chapters 1 and 2 of the TEP prepared by the evaluator. It will describe, in detail, the test scope and criteria, which will be used to define the required threat for a specific test.

Appendix B. Threat scenario. This is written by the TM and based on the OTDC provided by the evaluator, must describe the test setting from the threat force perspective. The test scope also defines the standard scenario to be used, the desired degree of realism, and the types of test events. It should summarize how the test will be conducted in terms of scheme of maneuver, organization and types of equipment, tactics, and supporting fires or forces.

Appendix C. Descriptions of the trials/test runs/vignettes. These are prepared by the TM and derived from the test factors and conditions and test design matrices provided by the evaluator, which define test force operations. The threat forces, equipment, and operations to be used in the test scenario must be adequate to provide an appropriate "OT environment" needed to resolve the OIC or exit criteria.

Appendix D. Firer/target matrix. Item level data requests, typically probability of hit (Ph) and probability of kill (Pk) numbers in the form of a firer/target matrix, prepared by the tester and TM, must be submitted through TRADOC Analysis Command to TRADOC CAC/TD and AMC DCSINT for approval.

Appendix E. The technical deficiencies of scheduled threat simulators, targets, and surrogate equipment and their impacts on the test, identified by the TAWG must be addressed in the Threat TSP.

Appendix F. Threat-related test limitations. These must be reported to the TM by the tester in order for their impacts on the validity of the threat to be portrayed to be assessed and described in the Threat TSP.

Appendix G. The threat force training plan. When force-on-force tests or tests involving threat player personnel are required, the supporting TM prepares the threat force training plan. It must be validated by TRADOC/CAC to ensure that the unit representing the threat force can execute the tactics and operations to be portrayed.

fIGURE 13-4.

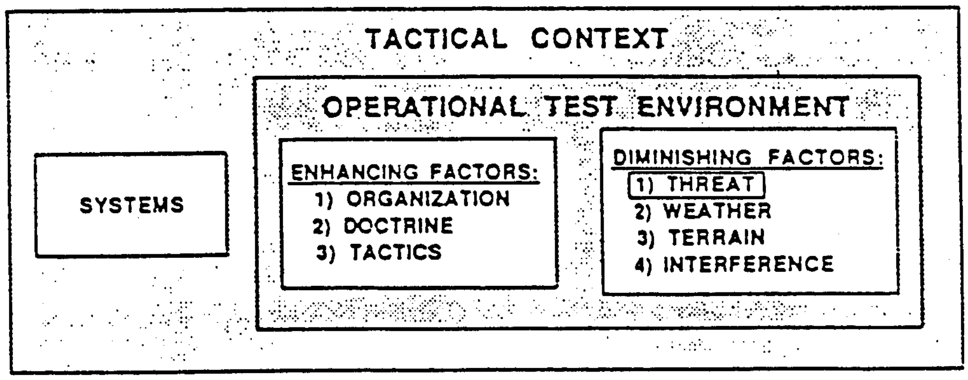


Figure 13-5. Relationship of the tactical context and the operational test environment.

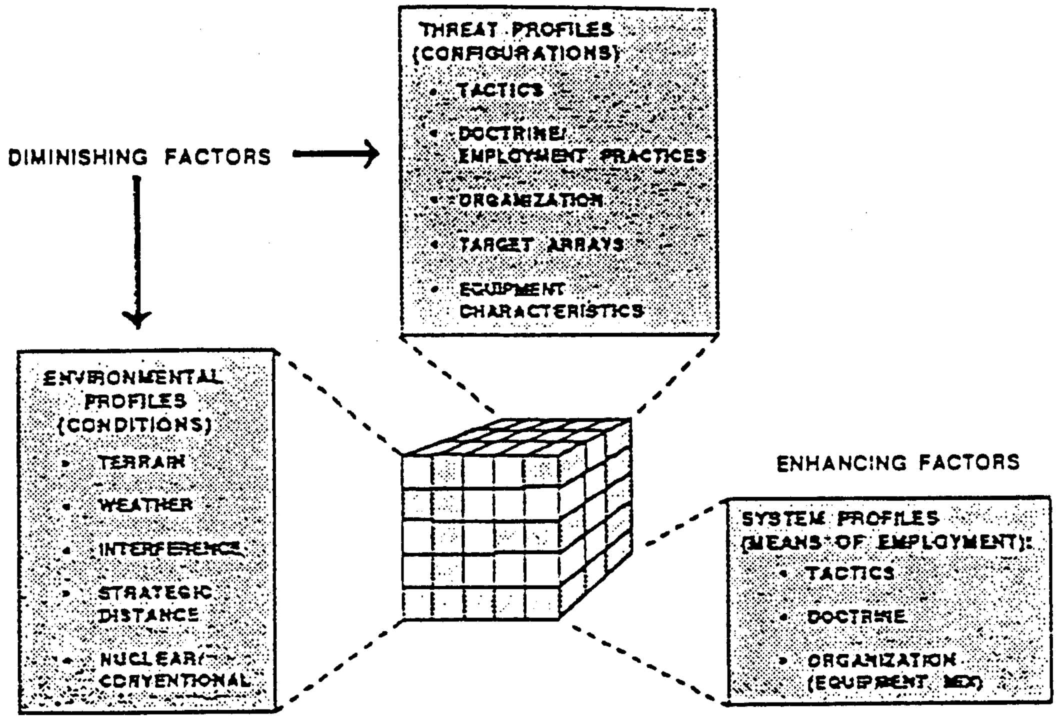


Figure 13-6. Test profile sets

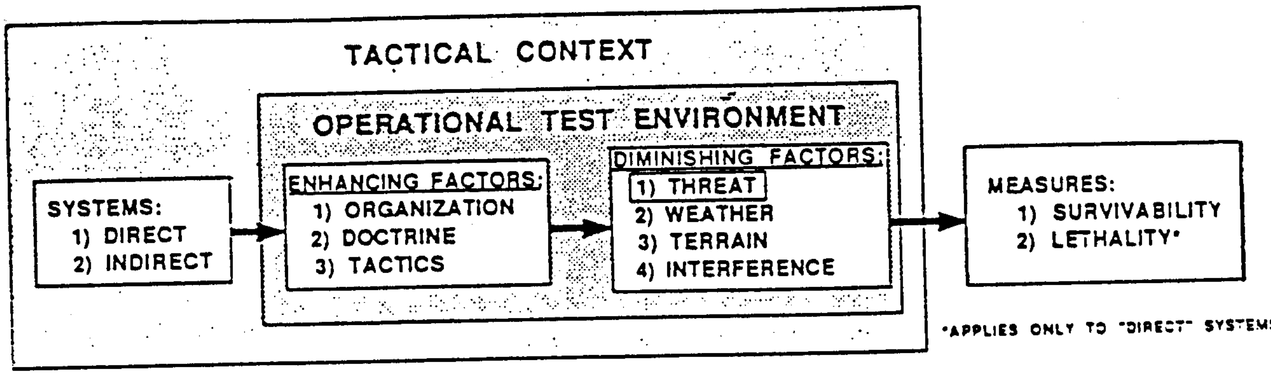


Figure 13-7 Factors influencing operational effectiveness.

Chapter 14
Survivability Considerations in Test and Evaluation

Section I
Introduction

14-1. General

a. Survivability and mission performance are the major components of a system's effectiveness. DOD policy requires that the survivability of all systems that must perform "critical" functions in a man-made hostile environment shall be essential consideration during the acquisition life cycle of all programs, to include development and non-developmental programs. System survivability against the full spectrum of battlefield threats found in the various levels of conflict shall be considered in all systems acquisition programs. These threats include ballistics; electronics warfare; nuclear weapon effects; nuclear, biological and chemical contamination; directed energy as well as advanced threats such as high power microwave/RF weapons, and kinetic energy weapons. This chapter deals with both conventional and nuclear survivability and describes the survivability characteristics and vulnerability of entire developing weapon systems (including crews) through T&E.

b. Although the exact procedures used to assess the survivability of any system may vary, the general approach is similar. It must address the relationships between the avoidance/evasive and vulnerability capabilities of the system,e.g., avoidance of being engaged, avoidance of being hit when engaged, and withstanding the effects when hit (vulnerability)(figure 14-1).

(1) Avoidance includes the tactics, techniques, and devices used to prevent detection; to evade, escape, or elude engagement; and avert being degraded by a threat. Avoidance includes dispersion; deception; camouflage-cover concealment; and the physical, electronic, and audio non-detection measures used to reduce or hide signatures.

(2) Vulnerability. There is no universal quantitative measure of survivability--especially at the aggregate force level, where survivability is complicated by employment of systems in combination.

(3) At the system level, survivability is fairly well

differentiated from mission performance and can be measured in terms of the fractional number of systems that are capable of continuing to perform their mission after confronting a specific threat using certain tactics, techniques, and devices under defined conditions over a finite period of time.

(4) This systems orientation is not intended to deny the importance of aggregated (force level) considerations on survivability, such as the impact of proliferation and the ability of other systems to neutralize a threat. Instead, this focus enables the operational tester to hold force level considerations constant so that a direct comparison between the old and new systems can be made.

c. Survivability in test and evaluation.

(1) Conceptually Survivability is the product of multiple series of conditional events that start with avoiding detection and extend through to the ability to repair systems damaged or disrupted by hostile forces.

(2) Estimates of survivability must take into account multiple exposures to a variety of threat systems in a scenario-dependent sequence. Because such exposures to threat systems are not normally independent, combat simulations often are used with variations in scenarios to estimate expected losses in a combat environment.

(3) A combat simulation may require various estimates, such as--

(a) Mobility.

(b) Probability of detection.

(c) Vulnerability of the evaluated system to various threat munitions, signatures, and associated enemy means of detection.

(d) Projected threat doctrine and tactics.

(4) These estimates must be determined by test results before a combat simulation is used. These estimates must be examined under varying factors and conditions, such as--

(a) Day versus night missions.

(b) Use of countermeasures and counter-countermeasures.

(c) Attack versus defense or other combat posture.

(5) If appropriate models are not available, one alternative may be to estimate survivability by calculating combinations of probabilities of relevant factors. These techniques for estimating survivability most closely reflect the approach used for survivability of conventional systems in a non-nuclear environment. They can be adapted, however, to include the effects of hostile EW against friendly communications and computer systems as well as to assess the survivability of all types of systems in a nuclear environment.

(6) In effect, survivability of a system in a hostile NBC environment may be oriented toward the ability to continue operations using protective equipment in the nuclear or chemical environment, rather than surviving a "hit" by a nuclear or chemical munitions. In the case of nuclear and chemical warfare, suppression may occur only on a strategic level and take the form of a capability for massive retaliation.

(7) Thus, as a practical matter, OT conducted to help resolve survivability issues for systems confronting nuclear and chemical threats would emphasize the defensive countermeasures taken to protect the crew and equipment rather than the strategic offensive actions to prevent first use of such weapons or to deny repeated use.

(8) It is important to note that all of these factors assume knowledge of current and projected threat systems, doctrine and tactics. Data gaps must be identified immediately through intelligence channels to the DCSINT DA TISO.

d. Probability of being engaged.

(1) The probability of being engaged involves the probabilities of being detected, acquired, located, and tracked. In some instances, an important factor may be the probability of the evaluated system being identified, given its has detection.

(2) The probability of being engaged also involves the probability of suppressing the threat systems by friendly forces. Figure 14-2 illustrates the factors that may affect the probability of being engaged and shows sample Drs for evaluating the potential for engagement.

(3) Obtain as much information as possible from the force-on-force aspects of OT, because OT may provide estimates of the true operational probability of being engaged.

(4) A system may be designed to reduce the probability of engagement (e.g., low radar cross-sections resulting from design and construction with radar-absorbing materials). The effect of design characteristics may be negated or reduced, however, by tactics and techniques such as night operations and terrain following, and by devices such as obscurant and jammers.

e. Probability of being hit when engaged.

(1) The probability of being hit when engaged involves such factors as evasive actions, suppression, use of decoys or other techniques, or devices that prevent the evaluated system from being hit by a threat munitions or device. Figure 14-3 illustrates example considerations for estimating the probability of being hit when engaged.

(2) The selected methodology should--

(a) Establish a baseline of threat effects against the evaluated system under benign or neutral conditions.

(b) Degrade the baseline threat performance with defensive countermeasures (tactics, techniques, and devices).

(c) Further degrade the threat effectiveness by suppressive actions. Suppressing the threat in this analysis does not presume that the enemy has fired (or acted) first, although suppressing an enemy who acts first is decidedly more difficult than suppressing a less active opponent.

(3) Although operational tests may provide information regarding the probability of being engaged (and its component elements), OT does not usually provide good information on the probability of being hit or killed. Vulnerability analysis, live fire survivability tests, and other analyses of threat impacts typically prove to be better sources of this information. It is important, however, to collect information regarding the relative distribution of ranges of engagement, typical angles of fire, etc., that occur under operational conditions to verify or modify these inputs to the vulnerability analysis.

f. Probability of being killed when hit.

(1) Figure 14-4 illustrates an example of considerations for estimating the probability of the system being killed when hit by a specific munitions or device.

(2) The ability to withstand threat effects when hit

involves such factors as --

(a) Whether threat munitions will overcome blue system protection mechanisms.

(b) Whether flammable or explosive materials will be hit.

(c) Whether passengers (in addition to crew members) are aboard.

(3) Because this probability assumes a hit, emphasis is on the vulnerability of the system and the designed hardness, robustness, and redundancy of the system, rather than on the actions that could be taken to avoid a hit. This vulnerability analysis of the system is the focus of TT. Testing a system's vulnerability is partly accomplished by actually firing threat munitions at the U.S. system (explained in the "Live Fire Test and Evaluation Guidelines" published in support of DODM 5000.2M and in response to the National Defense Authorization Act for FY 1987 (PL 99-661)).

g. Ability to repair or replace damaged or destroyed systems.

(1) Another aspect of survivability at the force level is the ability to repair damaged systems and replace destroyed or lost systems (see fig 14-1). This function overlaps extensively into the suitability area. Supply policies, logistic system capabilities, and individual weapon system RAM all influence the ability to repair and replace systems.

(2) Live fire testing may be used to provide data on the operational requirements to repair combat damage, which often cannot be determined during OT. You also may consider the benefit of allowing typical maintenance personnel to participate in the repair of vehicles subjected to live fire. Time required for diagnosis and repair of battlefield combat damage can be assessed in this manner.

(3) Systems subjected to live fire typically are repaired as quickly as possible for the next phase of live fire test. If maintenance by soldiers can be accommodated, however, the independent operational evaluator gains valuable information on adequacy of training, manuals, tools, and test equipment. Although the ability to repair and replace systems has survivability implications, such logistics actions are more properly addressed as suitability issues. See chapter 11 for a discussion of RAM issues, and chapter 10 for logistics

supportability.

h. Sequence for collecting data to support survivability evaluation. In the examination of survivability, the ability to withstand threat effects when hit would occur last in a sequence beginning with the ability to avoid being engaged. In the MAP, however, the survivability issues probably will be addressed.

14-2. Survivability measures

a. General. Chapter 4 explains the dendritic process for breaking down evaluation issues into MOEs and MOPs, and MOPs into Drs. The preceding paragraph illustrated an event dendritic for survivability. This paragraph refines that dendritic by providing factors and conditions that can assist the independent operational evaluator in structuring OT&E planning for survivability.

b. Survivability factors and conditions. Two general types of factors determine system survivability of a system and are refined further to satisfy the I&C established in the TEMP. They are, respectively, technical factors, which relate to characteristics of equipment such as hardness levels, system and component redundancy, and robustness, and operational factors, which relate to the tactics, techniques, and devices used to avoid destruction, damage, or disruption. Conditions are less controllable variables, such as crew motivation, that are influenced by determinants largely external to the test. Technical factors and conditions are generally straight-forward, e.g., technical specifications and controlled environments (see Part Six, Live Fire Testing). Operational factors and conditions include such variables as standoff distance, dwell and exposure times, aspect angles, target area presented to threat weapons, threat reaction time (detection), and target servicing time. Relating these factors to a function or event dendritic produces a framework for measurable operational survivability testing. An example of a factors and conditions chart for engagement avoidance factors is shown in table 14-2.

c. Evaluation phases.

(1) Operational evaluation of system survivability is done in four distinct phases (see fig 14-5):

(a) Reviewing the survivability factors, issues, requirements, and criteria developed in the survivability analysis.

(b) Assembling the results of modeling and testing conducted to respond to perceived deficiencies in the survivability factors.

(c) By using planned tactics, doctrine, and organization, determining whether the system satisfactorily overcomes or sufficiently mitigates those perceived survivability issues while in an operational test environment and thus meets the survivability criteria.

(d) Determining the impact of remaining deficiencies on survivability.

d. Review of threat support package. Review the TSPs (see chap 13) to ensure that the threat force sufficiently challenges the system under development and that the survivability issues will be answered. A useful aid in this process is to cross-check the factors and conditions matrices (see table 14-2) against the TSP.

e. Analysis of deficiencies. Analyze the parts of the system that are unable to meet the established criteria, and determine the degree to which these deficiencies adversely affect survivability.

Section II
Nuclear (residual), Biological, Chemical (NBC) T & E guidelines

14-3. The need for NBC T&E

a. The objective of NBC T&E is to support a timely and thorough assessment of the survivability of a system to the NBC threat as it progresses through its development an subsequent production phases. NBC contaminants pose a threat because they can adversely affect mission performance. Before discussing the effects of NBC contamination upon mission performance, it must be understood that the "N" in NBC includes only the secondary effects of nuclear detonation such as radioactive particulate fallout and the resulting induced gamma activity. Primary nuclear effects such as blast, initial radiation, thermal radiation, and electromagnetic pulse are covered in section III.

b. The U.S Army has mandated that all equipment required to perform mission-essential functions must be survivable in a nuclear, biological, and chemical (NBC) environment. This section describes the key steps for developing an acceptable NBC test strategy including the role of modeling and testing. It also provides guidance on the planning, execution, reporting, and

review and approval process and outlines the roles of key activities essential to the process.

14-4. Primary NBC Threat

a. The primary threat of NBC contamination to mission performance is the adverse effects these contaminants have upon personnel. In addition, the performance of a mission may be degraded because NBC contamination cause direct degradation of military equipment or indirectly hinders its employment. NBC contamination can have direct effects upon equipment by degrading critical properties (e.g., physical, chemical, mechanical, electrical, optical, or thermal) of the materials of construction. In addition, materials or procedures used to decontaminate equipment items also may degrade the critical properties of materials. The degradation of these properties will, in turn, reduce the capability of a component or system to perform an intended function. Indirect effects may arise if a system cannot be decontaminated to levels which are not hazardous to unprotected personnel. As a result, operators will be forced to wear individual protective clothing, which inhibits their performance. Limitations caused by the wearing of protective clothing include loss of tactile capabilities, reduced vision, and reduced work capacity. Decontamination of a surface may be hindered because the material of construction absorbs the contaminant, or the contaminant is trapped in cracks or crevices.

b. The threat posed by NBC contamination has been heightened due to the proliferation of NBC weapons by NATO, Third World, and former Soviet/Warsaw Pact nations. These weapons of mass destruction are becoming more readily available, technological advances are continuing to increase their military effectiveness and worth. Also, it has been estimated that 14 to 16 nations posses stocks of chemical weapons and the capability to conduct chemical warfare (CW).

14-5. Biological Warfare (BW)
Biological warfare capabilities are more difficult to gather and verify because the production and dissemination of biological agents can easily be disguised. Facilities normally used to manufacture pharmaceutical can be operated to produce BW agents and toxins. Dissemination of BW agents can be disguised as natural occurrences. In addition, the threat of BW agents and toxins has been enhanced because of the evolution of genetic engineering. This technology provides a means of expanding the number of toxic BW agents and toxins, increase their lethality, and defeat the effectiveness of existing antidotes and vaccines.

14-6. NBC Survivability Requirements

a. The requirement for NBC contamination survivable equipment resulted from growing capability of potential US adversaries to employ NBC weapons and the possibility that contamination of material by these weapons may degrade mission performance. In response to the threat, the US Army (lead agency for providing CB defense capability) issued Army Regulation (AR) 70-71, "Nuclear, Biological, and Chemical Survivability of Army Material," dated 1 April 1984. This regulation states that all mission-essential items or critical components of one or more mission-essential end items must be NBC contamination survivable. Mission essential material is defined to be that necessary to accomplish the primary or secondary function of a military unit or organization. The nuclear hazard is limited to the secondary nuclear effects or residual radiological contamination consisting of fallout, rainout, and neutron induced gamma activity. These residual hazards are distinguished from primary nuclear effects of blast, thermal, initial radiation, and electromagnetic pulse (EMP) which are addressed in Ar 70-60.

b. In a manner similar to its nuclear counterpart (AR 70-60), the NBC contamination survivability regulation (AR 70-71) establishes the policy and procedures for developing and acquiring NBC survivable material. This regulation states that NBC contamination survivability:

(1) Will be considered in all material requirements documents.

(2) Will have its criteria established during the program initiation phase and refined. If necessary, these criteria will be established during advanced development.

(3) Will be managed throughout the life cycle.

(4) Will have any criteria changes or waivers adjudicated only by the Nuclear and Chemical Survivability Committee.

14-7. Regulatory Guidance and Responsibilities

a. The regulation also identifies the various responsibilities of HQDA, MACOMs and other agencies in the development and implementation of the NBC contamination survivability programs. Of particular interest to the equipment developers are the responsibilities of the US Army Training and Doctrine Command (TRADOC), the US Army Nuclear and Chemical Agency (USANCA), and the Army Material Command (AMC).

(1) TRADOC is responsible for ensuring that NBC contamination survivability of material is considered early in the development cycle and that the survivability criteria are included in requirements documents. TRADOC policy and procedures are outlined in TRADOC Regulation 71-14.

(2) USANCA is responsible for providing the NBC contamination survivability criteria.

(3) AMC is responsible for:

(a) Establishing and maintaining a technology base in support of survivability.

(b) Developing Independent Evaluation Plans (IEPs) and reports (IERs) to assess survivability.

(c) Providing technical advice and assistance to all material developers.

(d) Serving on various committees where NBC survivability issues are of concern.

b. AMC has designated the Chemical Research, Development, and Engineering Center (CRDEC) the lead laboratory to set up a technical assistance program to support all material developers. CRDEC assists and supports the preparation of Requests for Proposals (RFPs), Request for Quotations (RFQs) and Statements of Work (SOWs). CRDEC also participates in Source Selection Evaluation Boards (SSEBs) and at key Design Reviews. In addition, CRDEC is assigned the responsibility to brief all Major Subordinate Commands on survivability and serve as a member of the Nuclear and Chemical Survivability Secretariat. Guidance for contractors and material developers is provided in a CRDEC publication, NBC Contamination Survivability: A Handbook for Development/Management of Material Programs.

Section III
Electromagnetic Environmental Effects (E3)

14-8. General

a. This Section of the Test and Evaluation (T&E) Procedures Guide is intended to provide guidance to acquisition managers on the integration of the Electromagnetic Environmental Effects (E3)

program into T&E processes. Electromagnetic compatibility and vulnerability testing and analysis will be conducted as part of the system's normal life-cycle T&E program in accordance with Army E3 test procedures.

b. The objectives of the Army's E3 program are to prevent electromagnetic interference, maintain electromagnetic compatibility standards and specifications, achieve electromagnetic compatibility for all electrical or electronics-dependent equipment, and attain built-in design compatibility through the use of after-the-fact remedies. However, it is not always feasible to protect every systems or subsystem from E3. If the system performance/measurements are less than the established E3 criteria, the level of compliance must be determined to access the impact on safety and mission or operational effectiveness throughout the life cycle.

c. Defense acquisition policy states that new systems must neither suffer nor cause unacceptable mission degradation due to electromagnetic environmental effects. The Army E3 Program implements Defense policy by insuring that all acquisitions follow a consistent set of processes: criteria development, assessment, planning and execution. An E3 Requirements Board (E3RB), composed of the Materiel Developer (MATDEV), the Combat Developer (CBTDEV), and matrix support engineer from the Army Materiel Command's (AMC) Major Subordinate Command (MSC), is formed for each program to direct and oversee the processes, and make recommendations to the program decision authority.

(1) Implicit in the E3 program is the understanding that it is neither feasible nor affordable to achieve perfect protection. The Army E3 Program is restricted to elimination of unacceptable E3 from materiel acquired for military use. Thus it becomes important to determine effects, assess their severity and likelihood of occurrence, and balance risk against mission success, while maintaining high standards of safety. The E3RB plays the key role in assessing the impact of effects, and whether a hardware or operational 'fix' is appropriate. The E3RB is the primary E3 advisor to the program decision authority, and works closely with the T&E community through the Test Integration Working Group (TIWG) to assure a smooth integration of test results, particularly when there are failures.

(2) The Army E3 Board is responsible for assuring the continuity and consistency of the Army E3 Program by bringing together representatives of AMC MSCs and other materiel developers, the Training and Doctrine Command (TRADOC), and Department of the Army elements in a common forum. The E3 Board

has a permanent working group concerned with T&E policy and process, but does not get involved with individual acquisition programs.

d. In the broadest sense, E3 includes any effect caused by electromagnetic energy, regardless of source, intent, or consequence. Friendly, and hostile emitters are included as well as naturally occurring phenomena. However, the principle focus of the Army E3 program is on the unintentional or accidental effects of the electromagnetic environment on military systems. The E3 program encompasses all electromagnetic disciplines, including electromagnetic compatibility (ECM), electromagnetic interference (EMI), electrostatic discharge (ESD), hazards of electromagnetic radiation to personnel, ordnance and fuels/volatile materials nuclear electromagnetic pulse (EMP).

(1) Electromagnetic radiation is an oscillating electric and magnetic field propagated through space at the speed of light. The E3 program is concerned with that portion of the electromagnetic spectrum from the lowest alternating current (AC) frequency (approximately 1 Hz) to the highest microwave frequency (approximately 300gHz). Electromagnetic radiation of higher frequency (i.e., shorter wavelength), classified as infrared, visible (i.e., light), ultraviolet, X-rays, and gamma rays is not part of the Army E3 program.

(2) Sources of electromagnetic radiation may be from intention emitters such as radio/TV transmitters and radar, unintentional emitters such as power lines and electrical motors, or natural phenomena such as lightning and static discharge. Electromagnetic energy may be of a continuous wave (CW) nature or it may be of a transient or pulsed nature. CW energy is described by its frequency and power level or amplitude while transient electromagnetic energy is measured in time and amplitude terms such as duration, risetime (from start to peak), and peak amplitude. Examples of CW sources include radio transmitters (a radiating source) and power lines (a conducting source). Examples of transients are lightning, electrostatic discharge (ESD), and a nuclear weapon generated electromagnetic pulse (EMP). Electrical noise generated by electrical switching and motors falls in the category of transients.

(3) Electromagnetic effects may range from audio or video interference/noise or disruption, control system malfunction, or erroneous or imprecise sensing. Effects may range in severity from a barely detectable threshold level, to catastrophic damage. The absorption of electromagnetic energy in munitions and fuels may be sufficient to cause unintentional firing or detonation.

(4) A well planned E3 testing program must be conducted at two levels. A sub-system test is performed on a functional part of the larger system, and will normally require a simulated local environment, connections to input and output ports of the item under test, and where appropriate, simulated signal traffic. Sub-systems are tested to evaluate sensitivity to the local (intra-system) electromagnetic environment, including that from other sub-systems.

(5) System level testing is normally accomplished by illuminating the test system with a uniform field, or a reasonable spot illumination, applied piecemeal over the system. Spectrum restrictions may preclude a full set of realistic frequencies in open air testing, thus limiting inter-system effects from other radiating systems. Laboratory tests, in shielded enclosures, anechoic chambers, or other special facilities must be used when open air testing is not feasible. New techniques of evaluating full systems are transverse electromagnetic wave, reverberation (TEM/REV) chambers, and synchronous current injection of all system coupling points.

14-9. Functional Relationships

a. The functional roles of the major Head Quarters Department of the Army (HQDA) staff and Army components relative to the implementation of the Army E3 Program are provided below. Only those roles which are specific to the Army's E3 Program are included.

b. Headquarters, Department of the Army (HQDA).

(1) The Director of Program and Vulnerability Assessment, Office of the Assistant Secretary of the Army (Research, Development and Acquisition) (SARD-D):

(a) Serves as the Army focal point for E3 policy and program implementation;

(b) Develops Army E3 policy guidance;

(c) Maintains oversight of E3 policy implementation;

(d) Provides overall assessment of Program Executive Officer/Program Manager (PEO/PM) E3 program accomplishments for system acquisition milestone decision reviews.

(2) The Deputy Chief of Staff for Intelligence:

(a) Develops and maintains non-United States (US) (i.e., enemy, allied and friendly) electromagnetic emitter information and databases.

(3) The Spectrum Manager:

(a) Establishes policy on the utilization of the electromagnetic spectrum for Army Systems;

(b) Approves system operating frequency requests (SF Form 1494).

(4) The PEO/PM:

(a) Incorporates Army E3 policy into system development and acquisition programs;

(b) Provides a voting member to the E3RB;

(c) Utilizes the approved E3 Criteria as baseline system performance requirements and incorporates the E3 Criteria into the system specification;

(d) Assures that adequate testing is planned and funded to determine system performance in the established E3 environment.

(5) The E3 Requirements Board:

(a) Is established for each system and is composed of one voting member from the MATDEV (i.e., PEO/PM or AMC MSC), CBTDEV (i.e., TRADOC), and the AMC MSC which provides engineering support to the MATDEV;

(b) Develops and approves system specific E3 operating environments;

(c) Establishes quantitative E3 Criteria based upon the Operational Requirements Document (ORD) and the approved E3 operating environment;

(d) Provides recommended E3 Criteria to the PEO/PM;

(e) Reviews adequacy of system performance against the approved E3 criteria;

(f) Recommends technical/operational solutions or modifications of the approved E3 Criteria.

(6) The Army E3 Board:

(a) Composed of representatives from HQ DA, Army Staff, HQ AMC, AMC MSCs and Research Development and Engineering Centers (RDECs), Army Materiel Systems Analysis Activity (AMSAA), TRADOC, US Army Information Systems Command (USAISC), Army Intelligence Agency (AIA), and Strategic Defense Command (SDC);

(b) Provides coordination of E3 Program activities between participating organizations;

(c) Acts as a clearinghouse for E3 information and serves as the focal point for standardization for E3 criteria and assessment methodology;

(d) Manages the formulations and modifications to Mission Area E3 environments;

(e) Provides technical advice and support to HQ DA and the Army Staff.

c. Army Materiel Command (AMC).

(1) The Deputy Chief of Staff for Acquisition (AMCAQ-AP):

(a) Serves as the AMC focal point for E3 policy and program implementation;

(b) Provides E3 oversight and coordinates support of AMC activities.

(2) The Army Materiel System Analysis Activity (AMSAA):

(a) Reviews Operational Requirements Document (ORD) to determine if the mission statement and operational concept are adequate to establish an E3 operating environment;

(b) Identifies E3 critical issues and incorporates E3 considerations into the Independent Evaluation Plan (IEP);

(c) Prepares Test Design Plans (TDPs) and incorporates adequate/appropriate data requirements necessary to evaluate E3 critical issues;

(d) Participates through the Test Integration Working Group (TIWG) process in planning developmental and operational testing;

(e) Evaluates E3 performance against E3 criteria; documents E3 test results and evaluations in the Independent Evaluation Report (IER);

(f) Provides a member to the Army E3 Board.

(3) The Test and Evaluation Command (TECOM):

(a) Identifies E3 critical issues and incorporates E3 criteria in the Independent Assessment Plan (IAP);

(b) Prepares Test Design Plans (TDPs) and incorporates adequate/appropriate data requirements necessary to evaluate E3 critical issues;

(c) Participates through the TIWG process in planning developmental testing;

(d) Evaluates E3 performance against E3 criteria; documents E3 test results and evaluations in the Independent Assessment Report (IAR);

(f) Develops and maintains comprehensive E3 test facilities and supporting capabilities;

(g) Conducts E3 testing in support of system development and testing programs;

(h) Develops and maintains US (i.e., military and civilian) electromagnetic emitter information and databases.

(i) For those systems assessed by TECOM, reviews ORDs to determine if the mission statement and operational concept are adequate to establish an E3 operating environment.

d. Training and Doctrine Command (TRADOC).

(1) TRADOC:

(a) Incorporates E3 considerations into operational concepts;

(b) Establishes qualitative E3 requirements for incorporation into requirements documents (i.e., ORD);

(c) Participates as a voting member of the E3 Requirements Board.

(d) Provides a member to the Army E3 Board.

e. Operational Test and Evaluation Command (OPTEC).

(1) OPTEC:

(a) Manages Continuous Evaluation (CE) and Operational Testing Programs;

(b) Manages the User Testing Program and evaluates testing processes to continuously improve these processes for the purpose of optimizing resources and improving products.

(2) The Operational Evaluation Command (OEC):

(a) Reviews the system COIC to determine if E3 should be included in the COIC;

(b) Executes CE Programs to ensure timely, complete, and independent operational evaluations.

(3) The Test and Experimentation Command (TEXCOM):

(a) Conducts operational testing to support CE and force development.

(b) Plans and conducts realistic operational testing which includes scenarios which expose the system to the projected electromagnetic environment.

f. MEDICAL RESEARCH AND DEVELOPMENT COMMAND (MRDC).

(1) Conducts research on the effects of electromagnetic/rf radiation on personnel;

(2) Recommends appropriate safety standards for personnel exposed to hazardous electromagnetic environments.

14-10. Test and Evaluation Requirements

a. Army guidance, as stated in this PAM, requires a system's E3 requirement be identified to the Test and Evaluation Management Agency (TEMA), and that the initial strategy and resource requirements be included in the Milestone I TEMP. The TEMP is the basic planning document by which the Army coordinates and approves the E3 test strategy for a given system. The PM is responsible for preparing the TEMP, in conjunction with the TIWG. It is prepared in accordance with the guidance contained in DOD

5000.2-M and Part II of this Pamphlet.

b. Test and Evaluation Master Plan. The TEMP defines and integrates test objectives, critical issues, system characteristics, responsibilities, resources, and schedules for T&E. The TEMP summarizes what, why, who, where, when, and how the E3T&E issues will be tested and evaluated. All E3T&E which impacts on program decisions will be outlined in the TEMP. The TEMP shows the relationship of the E3T&E issues to the required developmental and operational characteristics; describes the critical vulnerability issue and evaluation criteria; outlines the planned E3T&E; discusses the amount and type of E3T&E that will be performed to support each program decision point; and indicates where schedule, resource or budget constraints may impact the adequacy of planned E3T&E. The primary E3T&E resource requirements should be identified and addressed in the T&E Resource Section of the TEMP as early as possible, to facilitate budget/schedule projections; initial resource requirement should be identified prior to the Milestone I decision. This will also insure the early identification and programming of funds required for test execution. AMSAA/the Independent Developmental Evaluator reviews the TEMP and determines if the proposed testing is adequate to evaluate the E3 capabilities/limitations of the system. OPTEC/the Independent Operational Evaluator also reviews the TEMP to determine if the proposed testing is adequate to validate E3 operational considerations. Detailed guidance for the preparation of the TEMP is contained in Part II of this Pamphlet.

c. Test Integration Working Group. During the Concept Exploration/Definition Phase, the PM establishes the TIWG to facilitate integration of the T&E requirements. The TIWG serves as the forum for planning, coordination and integration of the E3T&E program. The TIWG is discussed in greater detail in Chapter 8 of this Pamphlet. The TIWG is assisted in defining the E3T&E program and in preparing the TEMP by the E3 Requirement Board member, who is appointed by the PM during the Concept Exploration/Definition Phase. The TIWG, with the assistance of E3 Requirements Board, updates the TEMP in preparation for each Major Milestone Review.

d. E3 Requirements Board. The E3 Requirements Board determines initial E3 criteria; evaluates the feasibility of meeting the criteria; conducts mission and hardening level trade-off analysis; and makes recommendations to the PM and the TIWG.

14-11. Developmental Testing and Evaluation

a. This section will address E3 testing and evaluation as it relates to the Army's Technical Test and Evaluation (TT&E) requirements. This section will describe the following as it pertains to TT&E planning, resources, execution, and reporting.

(1) Planning Independent Evaluation/Assessment Plan (IEP/IAP). The IEP/IAP is prepared in accordance with the procedures contained in Part IV of this PAM. Additional considerations are addressed below.

(a) If E3 has been determined to be a critical technical parameter for a particular system, it will be cited in the TEMP well as in the IEP/IAP. If E3 is not a critical technical parame ter, but is to be addressed during Developmental T&E, it can be cited in the IEP\IAP as a noncritical technical parameter. It is made up of several sub-elements. Sub-elements that may be addressed are as follows: Electromagnetic Interference (EMI), Electromagnetic Compatibility (EMC), Electromagnetic Radiation Operational (EMRO), Electromagnetic Radiation Hazard (EMRH), Electrostatic Discharge (ESD), Electromagnetic Pulse (EMP), Lightning Effects (LE).

(b) The criteria for these elements are defined in the IEP/IAP and are obtained from current Army E3 Military Standard (MIL-STD) requirements, as well as those developed by the E3 Requirements Board of the system. Figure 14-7 provides a generic overview of the E3 critical technical parameter as it might appear in an IEP/IAP.

(c) Test Design Plan (TDP). Prior to Developmental Feasibility Testing, a TDP shall be prepared in accordance with Part IV of this Pamphlet to outline specific testing and data requirements. Additional considerations are listed below.
(1) The TDP is a guide to the developmental tester in the development of the Developmental tester's Detailed Test Plan (DTP).

(2) Figure 14-8 provides a flowchart to assist in identifying necessary E3 testing.

(3) Once the E3 test matrix is determined, the TDP will outline the system test type, test criteria, and test data collection necessary for AMSAA's independent evaluation. Table 14-3 provides general references in determining a system, subsystem/component, and ordnance level testing, test criteria, and test operating procedures for E3 testing.

(4) EMI, EMC, ESD, LE, EMP, and EMRH have straightforward,

Critical Issue: How well does the system operate in its intended E3 environment?

Scope: This issue will examine the effects of various Electromagnetic Environments (EME) on the ability of the system to be transported, stored, and operated. This issue is concerned with the effects of unintentionally-coupled EM radiation (as opposed to intentionally directed EM) that the system is expected to encounter. The E3 critical issue is comprised of six sub-issues:

- Electromagnetic Interference (EMI)
- Electromagnetic Radiation Operational (EMRO)
- Electromagnetic Radiation Hazard (EMRH)
- Electrostatic Discharge (ESD)
- Electromagnetic Pulse (EMP)
- Lightning Effects (LE).

Criteria: The system will comply with E3-related design standards/requirements, MIL-STD requirements as they pertain to the system, and the operational electromagnetic environment as determined by the E3 Requirements Board (E3RB).

Methodology: The system will undergo E3 testing to determine compliance. Anomalies will be assessed for their impact on the system's operation.

Figure 14-1. An example of an E3 entry in the AMSAA IEP

unambiguous test requirements, criteria, and test procedures as outlined in the appropriate E3 documents. However, since EMRO considers the operational EM environment of the system, EMRO is by definition dependent upon the deployment of the system. The test criteria necessary to evaluate the EMRO criteria is provided by the E3RB of the system. AMSAA adopts the EMRO criteria in its independent evaluation. When a draft TDP is compiled it is coordinated with the TIWG members. When coordination is completed and the TDP is approved by AMSAA management, the TDP is provided to the developmental tester for use in developing the DTP.

b. Resourcing. T&E resources should be in accordance with Part IV of this Pamphlet. Refer to Table 14-4 of this Section

for specific test center resources for E3, and Table 14-11 for E3

(Insert fig.14-7)

c. Execution. Test execution shall be in accordance with art IV of this Pamphlet. Part IV of this Pamphlet specifically addresses E3.

d. Test Reporting. Test Incident Reports (TIRs) and test reports (TRs) should be done in accordance with Part IV of this Pamphlet.

(1) Independent Evaluation/Assessment Report (IER/IAR). The purpose of the IER/IAR is to document the results of the independent evaluation/assessment. They should be prepared in accordance with Part IV of this Pamphlet. As E3 is one of the critical technical parameters evaluated in the IER/IAR, the results from E3 testing are compared with user requirements and contract specifications to determine the system's compliance with E3 test criteria. Additional considerations are addressed below.

(a) The independent evaluation/assessment is performed based on results from the system testing, modeling/simulation, and other data sources (e.g., E3RB evaluations, contractor test reports, component test reports, etc.).

(b) To complete the independent evaluation/assessment, the results of the testing and modeling are compared to the performance criteria of the system. When a system does not meet the specified criteria, then an analysis is conducted to determine how the operation of the system is impacted by not meeting the criteria. The results of the E3RB as documented by the minutes are used to assist the evaluators/assessors in their impact assessment. Every E3 anomaly found in the system is analyzed to determine how the anomaly degrades the mission of the system.

(c) Figure 14-9 provides an overview of the E3 test and evaluation process. There are two possible approaches in conducting E3 anomaly investigations. One approach identifies the anomaly, conducts a fix (e.g., additional shielding, rebonding, etc.) and retests. Another approach assesses impact of the anomaly on the test item's operation or performance. It is advisable to attempt to fix the identified anomaly whenever feasible such that the item under test will meet its E3 criteria. However, the cause of many anomalies may never be adequately identified or may be expensive to fix. In the latter case, the

E3RB will evaluate the anomaly, assess its impact on the test item's operation/performance, and provide a recommendation on the future course of action based on the impact of the anomaly. The anomaly impact can be one of three possibilities: anomaly poses little or no risk in test item operation or mission impact (this will require a waiver); anomaly poses risk in test item operation but an operational fix[1] will address the risk (this will require a waiver); or anomaly poses risk in test item operation and will require a technical fix (this will require a retest).

(d) Once the impact is assessed, the evaluator/assessor will determine the ability of the system to operate in its E3 environment and provide a technical risk assessment of the system in meeting its E3 performance requirement.

14-12. Operational Testing

a. Operational testing applies to all materiel systems acquired under the AR 70 series regulations and all information management area (IMA) systems acquired under the AR 25 series. The different varieties of each of these main categories that are discussed in Part V of this Pamphlet. Operational tests are designed to answer whether troops can operate, maintain, and support the system when it is deployed in an operational environment. The common denominator for the different varieties of user testing is participation of typical user troops operating the system under test in an operational environment that is close to operationally realistic. The operational environment includes tactical operations conducted in accordance with wartime operational mission profiles as planned for tactics, doctrine, logistics, maintenance, and the postulated threat. The degree of operational realism differs between the varieties of user tests, because each variety has a different focus depending upon its purpose. Each variety of operational test may contribute toward the goal of the E3 program that Army materiel will accomplish its intended mission in the electromagnetic environment.

b. Planning. To support the E3 program, test planning for this category of user test should include scenarios that expose

[1] An operational fix is defined as a change in training, doctrine, and/or deployment such that the conditions causing the anomaly to occur can be either avoided or recognized as a transient phenomena.

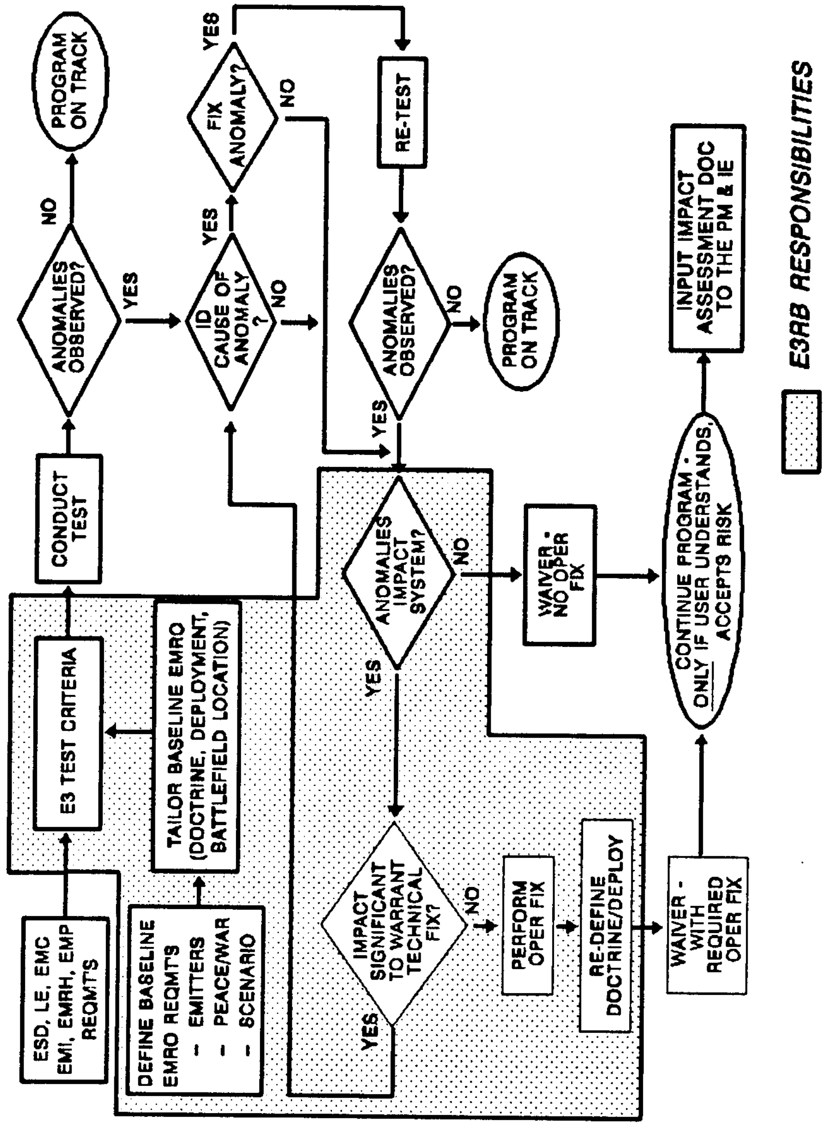


Figure 14-3 E3 Test Criteria, Test, and Test Evaluation Overview

the system to the projected threat electronic warfare and to friendly emissions from both other inter-operating systems and from systems operating in the vicinity. In actuality, safety and commercial frequency constraints often lead to test limitations upon the degree to which E3 testing may be conducted. Those responsible for planning this category of user testing must start coordinating as early as possible to develop a test plan acceptable to all agencies concerned and to obtain the necessary frequency clearances. The overall Army POC for frequency clearance matters is the Army Spectrum Manager (ASM), HQDA, ATTN: SAIS-SM, Room 2C513, The Pentagon, Washington, DC 20310. To support a frequency clearance request, the ASM requires a proposed test plan, system engineering explanations to justify that test plan, a postulated threat description, a complete list of frequencies that might be affected, the projected degree of those effects, and the geographic distribution of those effects. After assimilating this information, the ASM will work with the test planner to determine which E3 testing alternatives are viable. Additional guidance is found in Section C, Part 6, DODI 5000.2.

c. Resourcing is accomplished in accordance with Chapter 8, AR 73-1, and AR 37-100-XX. Refer to Table 14-4 of this Section for specific test center resources for E3, and Table 14-4 for E3 Organizations/Offices.

d. Test execution will be a representation of an approved scenario in accordance with AR 73-1. Discussion of scenario development will be in each system's TEMP in accordance with Part 7, DOD 5000.2-M, for AR 73 series systems or Part 7, DOD 7920.2-M. Additional guidance on execution is in Part V of this Pamphlet.

e. Reporting guidance is contained in Part V of this Pamphlet.

14-13. Continuous Evaluation (CE)

a. CE is a continuous process extending from concept definition into deployment which evaluates the operational effectiveness and suitability of a system by all available data. CE is addressed in greater detail in Chapter 2, of this Pamphlet.

b. Planning. As mentioned in paragraph 14-5b, operational testing in support of the E3 program can be constrained by safety and other restrictions. To overcome these potential limitations, the independent operational evaluator and the independent developmental evaluator must coordinate and integrate their

evaluation efforts to ensure E3 issues are adequately addressed. They will review the subject system's COIC. For command, control, communications, and intelligence (C3I) and IMA systems, they will analyze if E3 criteria are appropriate for the COIC and make recommendations to their commands during the staffing of the COIC. When necessary, the independent operational evaluator may develop Additional Operational Issues and Criteria to support the E3 Program. The two primary methods for integrating E3 testing are:

(1) the independent operational evaluator and the developmental evaluator work through the TIWG for the subject system to ensure the TEMP has an adequate plan for E3 testing;

(2) the developmental evaluator provides a test report covering E3 developmental testing to the independent operational evaluator who in turns adjusts the T&E strategy as appropriate to ensure all necessary E3 issues will be addressed by the Milestone III (Production Approval) decision.

c. Resourcing is jointly accomplished by the system's product/project manager (PM), the independent operational evaluator, and the developmental evaluator through the Test Schedule and Review Committee (TSARC) process and the budget processes of involved commands. A TEMP will include the resourcing required for each key testing activity. The evaluators must budget for other activities through their own directorates. Refer to Table 14-3 of this Section for specific test center resources for E3, and Table 14-4 for E3 Organizations/Offices.

d. Execution. The key to execution is gathering information from a variety of sources and analyzing trends to identify where areas of highest risk to the Army are. E3 is one of the areas that must be addressed.

e. Reporting. The preparation of IERs by both the operational and the developmental evaluators is addressed in Parts 5 and 4, respectively of this Pamphlet.

(insert table 14-8)

14-4. Test & Evaluation Command (TECOM)

a. Combat Systems Test Activity (CSTA). Located at Aberdeen Proving Ground, the Electromagnetic Interference Enclosure is a solid panel design shielded enclosure approximately 94'l x 60'w x 28'h with reinforced floors and large access doors (16' x 16').

An air intake and exhaust system with a 12,000 cfm capacity permits operation of equipment including engines within the enclosure during testing. All electrical power and communication lines entering the enclosure are equipped with 100 dB in-line filters. An instrumentation room, a 12'l x 12'w x 8'h solid shielded enclosure, is used to house the measuring and recording instrumentation. Computer-controlled instrumentation is available for controlling, measuring, displaying, and recording data in accordance with MIL-STD-461, 462, and 463 series on EMI testing. RF power sources are available to provide the RF frequencies and field intensity levels specified for MIL-STD-461C. The Electromagnetic Environmental Test Facility (EMETF) is used to determine the ability of C-E equipments and systems to operate in their intended operational environments without suffering or causing unacceptable degradation because of unwanted electromagnetic radiation or response. Testing capabilities address unintentional interference as well as vulnerability to electronic countermeasures (ECM). The EMETF performs laboratory and field testing, modeling and simulation, and research and development activities. The EMETF has five empirical measurement facilities, a mobile field test facility, and a field test area. The mobile field test facility and the empirical measurement facilities are used to determine equipment characteristics and the degree of degradation that different types of interference cause to C-E and weapon systems, and the conditions under which this occurs. The five empirical measurement facilities are: the Instrumented Workshop; the Spectrum Signature Facility; the Voice Scoring Facility; the Electro-Optical Test Operation; and the Stress Loading Facility. Empirically derived data are used in conjunction with the EMETF analytical computer facility and a library of computer models to analyze the probability of satisfactory operation or system effectiveness of tested systems or equipment when deployed in a tactical environment. Analyses are performed to determine not only the impact of the electromagnetic environment on equipment or systems, but also the impact of equipment or systems on the environment. The library of computer models used for these analyses of C-E equipment and systems in turn use realistic simulated tactical deployment data bases.

(1) Instrumented Workshop. The Instrumented Workshop (IWS), while primarily used for link measurement tests, to include encrypted links, also supports exploitation efforts. For link measurements, the IWS uses three shielded screen rooms into which the Test Link Transmitter (TLT), Test Link Receiver (TLR), and Interface Generator (IG) are placed. Through the use of coaxial cable and programmable attenuators, a realistic communications link is established between the TLT and TLR. The

J/S level is then altered to establish the system-under-test's performance under ECM conditions. The output data for each individual test can be printed in camera-ready format then or later for direct inclusion in a report.

(2) Spectrum Signature (SS). Spectrum signature measurements of communications-electronics equipment characteristics can be performed in accordance with Military Standard 449C, or as required by the specific project. Measurements of transmitter, receiver, and antenna characteristics are performed as well as specialized measurements on missiles, automatic data processors, switching equipments, and weapon systems. Mobile vans for field measurement requirements are also available. Each van is equipped with shielded enclosures and a complete range of signal generators, spectrum analyzers, distortion analyzers, and other specialized measurement equipments covering a frequency range from 50 kHz to 40 GHz.

(3) Voice Scoring Facility. The Voice Scoring Facility has the capability of scoring voice intelligence transfer that occurred over clearer degraded (interference and/or jamming) analog and digital communications links. The facility can score carrier-phrased phonetically-balanced (PB) words and diagnostic rhyme test (DRT) words. The facility contains eight listener console positions and, in a separate room, a control position with a one-way mirror for observing the listeners. Each listener console contains a video monitor, a touch wand, a high-fidelity headset, and a volume control. The control console contains a personal computer (PC) and a high-fidelity playback machine. The PC with its programs is used to put words to be scored on the video monitors. Listeners' video monitors are touch-screen sensitive. Listeners touch the word (that they think they heard) on their touch screens with their touch wands. PB words are used in the analysis of analog circuits. DRT words are used in systems developments and in digital circuits. A very high degree of repeatability has been demonstrated over periods as long as five years.

(4) Electro-optical Testing Facility. Tests of the equipment can be made both in the laboratory and in the field over the wavelength interval from ultraviolet to the far infrared. Currently, methodologies and test equipment are being developed to test imaging Automatic Target Recognition systems. In this case, the sensors can be television, forward-looking infrared and synthetic aperture radar. An emphasis on sensor fusion will allow EMC and EMV testing of military hardware using integrated data from multiple sensors.

(5) Stress Loading Facility. The Stress Loading Facility (SLF) bridges the gap between field tests and software simulations by providing a realistic RF environment with controlled and repeatable conditions. The SLF provides a low-level RF environment in a closed facility which limits emanation of RF signals from the test environment while preventing contamination from the external RF environment. The SLF can be used to test a system below, at, or above its specification limits. The SLF consists of three subsystems:

(a) The Communications Threat Simulator (CTS) is capable of generating a wide variety of waveforms from voice, digital, and jamming to commercial television in the 0.5 to 500 MHz band. The CTS consists of 32 signal sources (expandable up to 128 sources).

(b) The Non-Communications Threat Simulator (NCTS) can simulate up to 1024 dynamic pulsed emitters on a time-multiplexed basis. The emitters simulated include pulsed radar, navigational and other non-communications signals in the 0.5 to 18 GHz band (with future enhancements up to 40 GHz and selected higher frequencies).

(c) The Functional Systems Simulator (FSS) is a software and hardware subsystem which simulates ancillary hardware or software processing for the system under test. Functions of the FSS include simulating support/control systems associated with the test system, monitoring system performance, generating scenarios and running predesignated scenarios.

(d) Mobile Field Test Facility. The Mobile Field Test Facility consists of jamming, intercept, control, and monitoring equipments which are used to gather data to address the issues of specific tests. Equipments are configured into three transmitter and two receiver/monitor vans which can be utilized at a variety of test sites. Additionally, the EMETF has six modular palletized generic jammer systems for either airborne or ground use. The six modular palletized jammer systems are currently configured to operate from a EH/UH-H helicopter or to be trailer-mounted for ground-based use. Various modulation types are available, including CW comb, Gaussian noise, or any waveform which can be generated by a waveform synthesizer. Operation of the palletized jammers is computer controlled via the jammer operator's keyboard/monitor. Jammers can be programmed for specific effective radiated powers, transmission times, comb generator frequencies enabled, calibration statuses, and RF power outputs versus times. The performance of the jammer can be

automatically monitored and recorded. The EMETF has three semi-trailer, van-mounted generic jamming systems. The jamming systems can generate a wide variety of waveforms for radar simulation, radar jamming, communications simulation, and communications jamming. Power amplifiers and antennae are available covering from 0.5 MHz to 18 GHz. Equipment can be configured and operated automatically, remotely, or manually. Each van's antennae can be accurately positioned from 0 to 360 degrees in azimuth and to +45 degrees in elevation. The two EMETF intercept/direction finding vans are semi-trailer mounted generic intercept/DF systems. The receiving systems can be controlled manually, via console keyboard, or by computer for automatic functions of intercept and DF. A variety of search option modes are available. In all modes, the system is capable of automatically determining received signal strength, signal frequency, pulse width, pulse repetition interval (PRI), pulse repetition frequency, average pulse width, average PRI, and angle of arrival. Recording of individual receiver video output, timing signals, and command and control communications is possible during test. The receiving systems cover from 1 to 18 GHz. The antennae can cover from 1 to 40 GHz. One van has automated receiving, signal analysis, and DF capabilities.

(e) Field Facility. The field test area consists of 5000 acres checker boarded within a 40 x 60 mi area. It may be used to test all types of communications and electronic systems under open field conditions. The extremely low level of background radio and electronic signals enables equipments to be tested and evaluated under controlled interference conditions without background signals which could bias measurements.

(f) Analytical Facility. The EMETF uses computer-based modeling to simulate and analyze EMC, EMV, and performance of C3I test items. Model simulations and computer analyses are conducted on a CDC CYBER 180 model 830 computer system housed in a secure facility. Model development is enhanced through the use of the Simulation Language for Analysis of Communications Systems (SLACS) developed by the EMETF. An extensive library of software models allows the EMETF to simulate test item C-E functions, and to support battlefield scenario activities, threat electronic warfare, and intelligence activities. The EMETF can draw from applicable portions of these models to support specific customer requirements. Models contain propagation algorithms for calculating signal and performance levels for each equipment under various propagation modes, terrain conditions, and distances. Empirical data on the performance of the equipments or systems under varying conditions of intentional or unintentional interference, simulated tactical deployment data

bases of the tactical environment, and parametric data bases drive models during simulated runs. The simulated tactical deployment data bases are developed in-house to meet customer and threat-community specifications, and include RED, BLUE, and GRAY elements as appropriate. Simulated tactical deployments have varied in size from small to echelons-above-corps (EAC). Model outputs are detailed histories of simulation activity, test item operation, and model processes. Post-processing routines use detailed history files to generate reduced data and statistical summaries to analyze test item EMC, EMV, and performance. Modeling and simulation analyses permit customers to evaluate system designs, product improvements, deployment and operations concepts, equipment mix options, mutual interference issues, and vulnerability concerns. The Computer Automated Analysis Capability uses a library of computer models in conjunction with a multiple user CDC CYBER 180 model 830 computer to perform electromagnetic compatibility and vulnerability analyses of communications-electronics concepts, systems, and equipments in typical tactical environments. This library of computer models consists of computer programs and routines for use in a variety of electromagnetic compatibility evaluations. An analysis model for a specific task is constructed by selecting from the library of programs of the routines necessary to perform the particular task analysis.

(g) Electromagnetic Interference/Tempest Test Facility. The Blacktail Canyon EMI/TEMPEST facility is located in a remote RF isolated area of Ft. Huachuca. The remote location provides a relatively low electromagnetic ambient environment which optimizes open-field testing. The facility location in conjunction with a 400 ft by 360 ft perimeter fence provides the degree of physical security required for mission tests. Testing can be accomplished in accordance with the following standards: EMI (MIL-STD-461C and MIL-STD-462); TEMPEST (NACSIM 5100A, NACSIM 5112 and KAG 30); and IEMC (MIL-STD-6051).

(1) Three EMI/TEMPEST test chambers include: a 44 ft long by 22 ft wide by 18 ft high anechoic chamber which provides 120 db of RF isolation and will accommodate military equipment up to the sizes of the HMMWV, CUCV, LAV, and M113 families; a 26 ft long by 16 ft wide by 11.5 ft high TEMPEST/EMI chamber providing 100 db RF isolation; and a 12 ft long by 10 ft wide by 11 ft high shielded room for testing of small items.

(2) Facility instrumentation suites consists of the following: two Dynamic Sciences, Inc. TEMPEST test systems providing automatic NACSIM and KAG testing requirements; two automated AILTECH RFI/EMI data collection systems providing

support to MIL-STD-461C/462 radiated and conducted emission testing from 20 Hz to 40 GHz; an integrated EMI susceptibility system allowing RF illumination of equipment from 10KHz to 40 GHz; and an extensive assortment of parallel element, rod, biconical, log periodic, and double ridge guide antennae, along with associated RF amplifiers and electric field probes which can provide RF illumination and detection capabilities across the 40 GHz spectrum relevant to the EMI/TEMPEST arena.

(3) The EMI/Rab data collection and TEMPEST systems provide sufficient portability to allow performance of EMI/TEMPEST tests at remote locations. Remote TEMPEST testing is also accommodated with two mobile vans. One van is equipped with a Watkins-Johnson manual TEMPEST measurement system. The remaining van houses a DSI 9000 seri[illegible] automated TEMPEST measurement system.

(h) The Test Item Simulator (TIS) is a computer-based test driver used to simulate C3I systems in a test environment. The TIS generates and records a data environment which exercises and stresses systems under test to measure their performance (system, software, and interoperability). The TIS provides controlled and repeatable technical and operational simulation representing multiple C3I/IEW systems to the system(s) under test and monitors and records their responses in real-time. It represents tactical systems by transmitting a controlled and repeatable message stream using the tactical system message formats and protocols. The TIS consists of both small and large capacity systems. The large system is mounted in two 40 foot semi-trailer vans while the small version is installed in a ruggedized case for operation in a field environment. The Antenna Measurement Facility is used to determine radiation patterns from both mounted and unmounted antennas. The facility consists of a 114-foot nonmetallic tower, 177-foot sensor-bearing arc, and two rotating turntables 30 feet in diameter, one under the arc and the other 500 feet east of the tower. The facility is used for testing electronic equipment or antennas from 0 to 100 feet above the ground. The arc is an antenna measurement facility and makes possible the determination of antenna patterns of various radiating devices while they are in operational position on the aircraft. The arc is constructed of laminated wood and has essentially free space characteristics above 1000 MHz. In addition to the arc with its 75 foot radius and the turntable, this system includes a rotatable platform which can support inverted aircraft airframes (up to 10 tons weight). The facility is equipped with instrumentation for the evaluation of antenna systems from 50 MHz to 18 GHz. This facility is used to determine radiation patterns from both mounted and unmounted

antennas and complements the Antenna Measurement Facility. The usable frequency range is from 6 GHz to 40 GHz, with potential increase to 95 GHz. The positioner can hold test objects (such as aircraft and ground vehicles) weighing up to 70 tons, 42 feet above the ground, and rotate the test object in both azimuth and elevation. Five different feed horns cover the frequency ranges: 6-8 GHz, 8-12 GHz, 12-18 GHz, 18-26.5 GHz, and 26.5-40 GHz. The 75 foot diameter parabolic reflecting antenna produces a collimated beam with a 50 foot diameter flat wave front (or quiet zone).

c. Redstone Technical Test Center (RTTC)

(1) Electromagnetic Interference (EMI) Test Facility. The EMI test facility consists of a 13 foot by 30 foot double shielded, copper screen room, divided into a test and a control room. The facility is capable of measuring emissions and susceptibilities during subsystem and system tests as specified in MIL-STD-461 and MIL-STD-462. All measurement equipment is periodically calibrated and the major components, such as frequency synthesizers, spectrum analyzers, and power meters, are controlled by an HP 1000-A400 computer to enable rapid quantitative measurements to be obtained, recorded, and plotted. To ensure that there are not problems when assembled into a weapon system, items may be tested to determine the effects between subsystems, effects of subsystems upon external systems, and effects of external systems upon the subsystem.

(2) Electrostatic Discharge (ESD) Facility. ESD testing of components or systems is conducted to verify the safety and survivability of those items. Survivability is assessed by proper system operation following exposure. Safety is determined through a set of go/no-go tests or through instrumented tests and comparison to a database. Go/no-go safety tests typically focus on munition firing circuits, particularly the EEDs or other types of initiators. In these one-shot tests, the actual EEDs are installed in the munition to be tested. The failure criteria is the functioning of the device or a change in a critical parameter, such as the resistance of the bridgewire. Instrumented tests require the development of sensor packages to replace the EEDs and/or to monitor firing circuit test points, such as within a S&A subassembly. High frequency fiber optic data links, transient digitizers, and computer controller and analyzer equipment are used to acquire and analyze the needed data. Ion Physics Corp. electrostatic generators capable of 0 -+ 30 kv and 0 -+ 300 kv, and HIPOTRONIC 8000 Series Power Supplies and high voltage capacitor banks are used for personnel borne and helicopter borne tests. These tests can be conducted on both

inert and live tactical missile system hardware.

(3) Electromagnetic Pulse (EMP) Facility. The EMP test facility is used to conduct tests simulating the high altitude EMP waveform as defined in DOD-STD-2169A and Quadripartite Standardization Agreement (QSTAG) 244, Edition 3. The facility is a radiated freefield type simulator and consists of a 100 kV pulser, 10 meter diameter horizontally polarized dipole antenna 305 meters long, power distribution system, pulser control station, and shielded instrumentation van. System peculiar instrumentation, fiber optic data links, transient digitizers, and computers are used to acquire and analyze system EMP effects. EMP testing is conducted to determine weapon system safety and survivability and is usually performed at the system level.

(4) Electromagnetic radiation hazard (EMRH) and electromagnetic radiation operational (EMRO) facilities. EMRH and EMRO system test criteria are contained in MICOM Technical Report RD-TE-87-1. These criteria are based on analyses of the electromagnetic environments for Army deployments, Navy shipboard environments, and North Atlantic Treaty Organization (NATO) requirements. These criteria are periodically reassessed to accurately reflect the evolving environment. Detailed mission definitions are used to tailor these criteria for specific weapon systems.

(a) Broadband transmitters are utilized for Continuous Wave (CW), Amplitude Modulation (AM), Frequency Modulation (FM), and Pulse Modulation (PM) testing with several subsets of antennas covering the 100 kHz to 18 GHz frequency range.

(b) Future expansion includes fabrication of a 40 feet wide, 70 feet long, 22 feet high anechoic chamber for testing weapon systems and components. This facility includes a full 360 degrees of rotation turntable capable of accommodating a tracked vehicle the size of a M-270 launcher (MLRS). The frequency coverage of this test chamber will be 100 MHz to 40 GHz.

(c) EMRH testing requires instrumentation of the firing circuits and electric pyrotechnic initiators. Since missiles are designed in a wide variety of configurations and use a number of different initiators, calibrated instrumentation is a significant design problem for each test program. The EM&NE Test Function has an established capability for accurate instrumentation design, fabrication, and integration so that the instrumentation does not introduce additional ports of entry for EMR into the system. This capability results in reproducible test data and provides the basis for accurate safety margin calculations.

(d) Since the coupling of the system is a function of its orientation and the characteristics of the EMR environment, extensive testing is required to assess the electromagnetic environmental effects. System operation assessment requires parameter extraction from the system, as well as equipment used to simulate the mission. Again, the established capability of the EM&NE Test Function to design, build, and install hardened, fiber optic coupled telemetry provides a timely, cost effective approach to EMRO instrumentation.

(5) Lightning test facilities. Testing for evaluating the effects of lightning may be divided into two categories, direct strike and close lightning (i.e. magnetic and electric fields). Test criteria are derived from MIL-STD-1757, Lightning Qualification Test Techniques for Aerospace Vehicles and published in MICOM Technical Report RD-TE-87-1. Lightning simulation generators capable of generating up to 3.6 million volts and 200,000 amperes are used for these tests.

(a) Direct strike test criteria are primarily required for weapon system safety and secondarily required to prevent permanent damage to system electronic components. Tests are conducted to verify that the system is safe from premature launch or detonation of hazardous items when subjected to a direct lightning strike.

(b) Close lightning strikes sometimes referred to as Lightning Electromagnetic Pulse (LEMP) criteria are required primarily for protection of EEDs and electronic components from detonation, burnout, destruction, etc. Large magnetic and electric fields are radiated from lightning strikes, and it is necessary to design missile systems to withstand these environments during a launch sequence or when the electronics are active.

(c) Testing is conducted on both inert and live, tactical missile systems. Testing is also conducted by go/no-go testing of actual EEDs or squibs or by using instrumented devices to measure transient currents and voltages induced in the bridgewire of each test item.

(d) The RTTC lightning test capabilities consist of three distinct test facilities. The Inert Lightning Test Facility is utilized for instrumented and go/no-go testing of systems limited to Class 1.4 explosives. The Hazardous Lightning Test Facility is comprised of two facilities which are tailored for test object size and explosive quantity. The Small System Lightning Test Stand is utilized for testing live, tactical man-

portable and other small missile systems. The Large System Lightning Test Stand is utilized for testing larger live, tactical missile systems and is currently limited to 100 pounds of Class 1.1, 5,000 pounds of Class 1.2, 15,000 pounds of Class 1.3, and unlimited Class 1.4 explosives.

(e) The Lightning Test Facilities at RTTC are unique in that they are the Army's only lightning test facilities. The Hazardous Lightning Test Facility is especially unique in that it is the only facility in the free world capable of testing live, tactical missile systems to the lightning environment. This facility also has a portable environmental conditioning chamber capable of conditioning tracked vehicles to both "Hot" and "Cold" temperature extremes.

d. WHITE SANDS MISSILE RANGE (WSMR)

(1) WHITE SANDS EMP SYSTEMS TEST ARRAY (WESTA). The White Sands EMP Systems Test Array (WESTA) provides a test environment simulation of an exoatmospheric nuclear weapon detonation. The facility is a bounded wave type with the EMP environment radiating into a working volume 13.4 m^2 and variable in height between 6.7 m and 15.5 m. The system uses a unique array type antenna which combines elements of both bounded wave and free field generators. The array is made up of 54 antenna modules in a 3 x 18 configuration, each module consisting of double density aluminum screens arranged to form a dihedral horn. Each horn radiates like a free field radiator and the array, as a whole, provides the field uniformity and high field strengths associated with bounded wave systems. WESTA generates a horizontally polarized plane wave with the pointing vector perpendicular to the ground. This configuration provides the most stringent test of ground based systems where the ground reflection is an important factor.

(a) WESTA produces a double exponential pulse with a risetime on the order of 10 ns, a 1/e decay time of 280 ns and a pulse duration of 740 ns. The free field peak E-field amplitude is variable between 100 and approximately 50,000 V/m. EMP fields within any arbitrary horizontal plane are uniform to within 5% of the mean field intensity except near the dihedral horns and the edges of the array. Test level reproducibility is within 3%. Maximum pulse repetition rates are output level dependent varying from 12 to 48 pulses per second below 7,000 V/m, one pulse per minute up to 20,000V/m, 30 pulses per hour up to 15 pulses per hour at higher output levels.

(b) An optical fiber analog data transmission system is available for transmitting data from the exposure volume to the instrumentation building where real-time digital acquisition and processing are performed and hard copy of the results made available within seconds. Pulse response time for this system is 1.5 ns with better than 1% linearity over its input range. Facility instrumentation can measure both system response and field strengths. A variety of bulk current and differential voltage probes is available for system response measurements, while B-dot and D-dot sensors are available for test environment characterization.

(2) ELECTROMAGNETIC RADIATION EFFECTS TEST FACILITY (EMRE). The Electromagnetic Radiation Effects Test Facility, is located approximately 8.5 miles north of the WSMR cantonment area. A wide range of electromagnetic testing can be accomplished in an outdoor environment, in a 60 ft x 60 ft x 12 ft shielded enclosure, or in a 20 ft x 14 ft x 12 ft anechoic chamber. For outdoor testing, EMRE has four testing areas (two of which are provided with 30 ft diameter turntables with capacity of 120,000 pounds) and seven transmitters (with CW, AM, FM and pulse modulation) which can provide field intensities in excess of 200 V/m from 100 KHz through 18 GHz. Sweer capabilities are provided in the ranges of 20 KHz through 225 MHz and 500 MHz through 18 GHz. Capabilities and facilities exist for development, fabrication, and installation of necessary instrumentation. In addition, electrostatic discharge facilities capable of testing up to 400,000 volt levels are available for simulation of discharge of electrostatic energy which may be developed on aircraft and/or personnel.

(a) The Electromagnetic Interference (EMI) Test Facility, part of the EMRE Test Facility, contains a 20 ft x 14 ft x 10 ft anechoic chamber and a 60 ft x 60 ft x 12 ft shielded chamber. Test criteria and test instrumentation are in accordance with MIL-STD-461. The EMI facility has signal generators, receivers, and antennas which cover the frequency range from 20 Hz to 18 GHz.

(b) An additional capability of the EMRE Facility is the Antenna Measurement and Radar Cross Section Measurement Facility. This facility is used to determine radiation patterns from both mounted and unmounted antennae. It consists of a 300 ft tower with an elevator and a 30 diameter turnable with a capacity of 120,000 pounds. The tower is used to perform antenna measurement and radar cross section measurements with look-down angles of up to 60 degrees. This capability permits EW assessments and signature measurements on large targets while

rotating them through 360 degrees in azimuth.

(3) The Countermeasures Waveform Control System (CWCS) provides controlled stimuli to radar or communications receivers and records and analyzes their responses. The system operates at frequencies between 500 MHz and 18 GHz in either continuous or pulsed mode with a duty cycle ranging from 0 to almost 100 percent and is capable of frequency, amplitude, or phase modulation. The system has extensive computer-driven control and analysis capabilities.

(4) The Multi-Purpose Monitoring System (MPMS) consists of mobile instrumentation vans for monitoring the RF environment during ECM and ECCM testing of air defense, fire support and C3I systems. The MPMS has direction finding antennae, receivers, and associated instrumentation to measure and document the RF environment from 100 KHz to 18 GHz in terms of frequency, pulse width, and direction to the RF source. Two mobile systems are currently available.

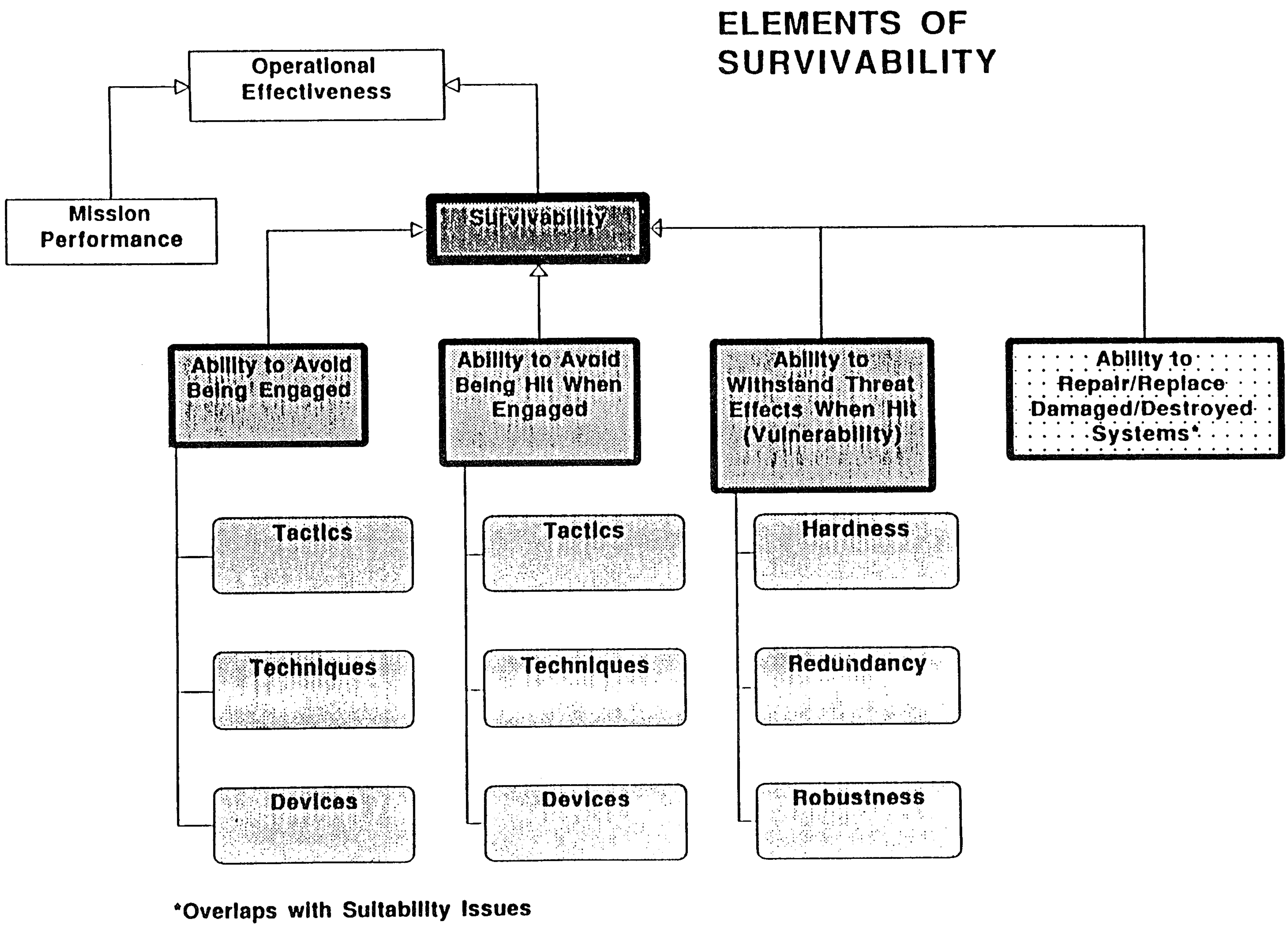


Figure 14-1. Elements of Survivability

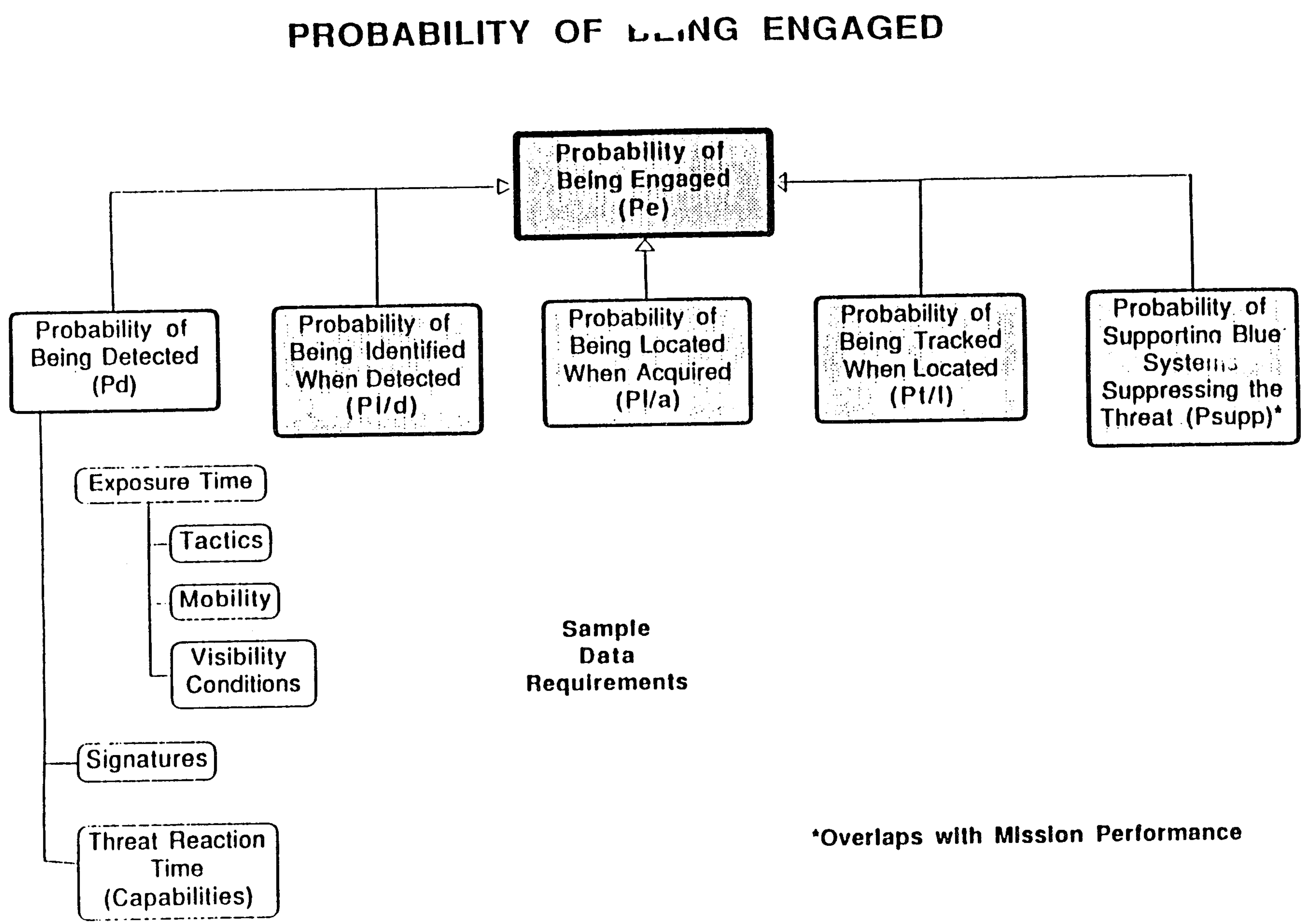
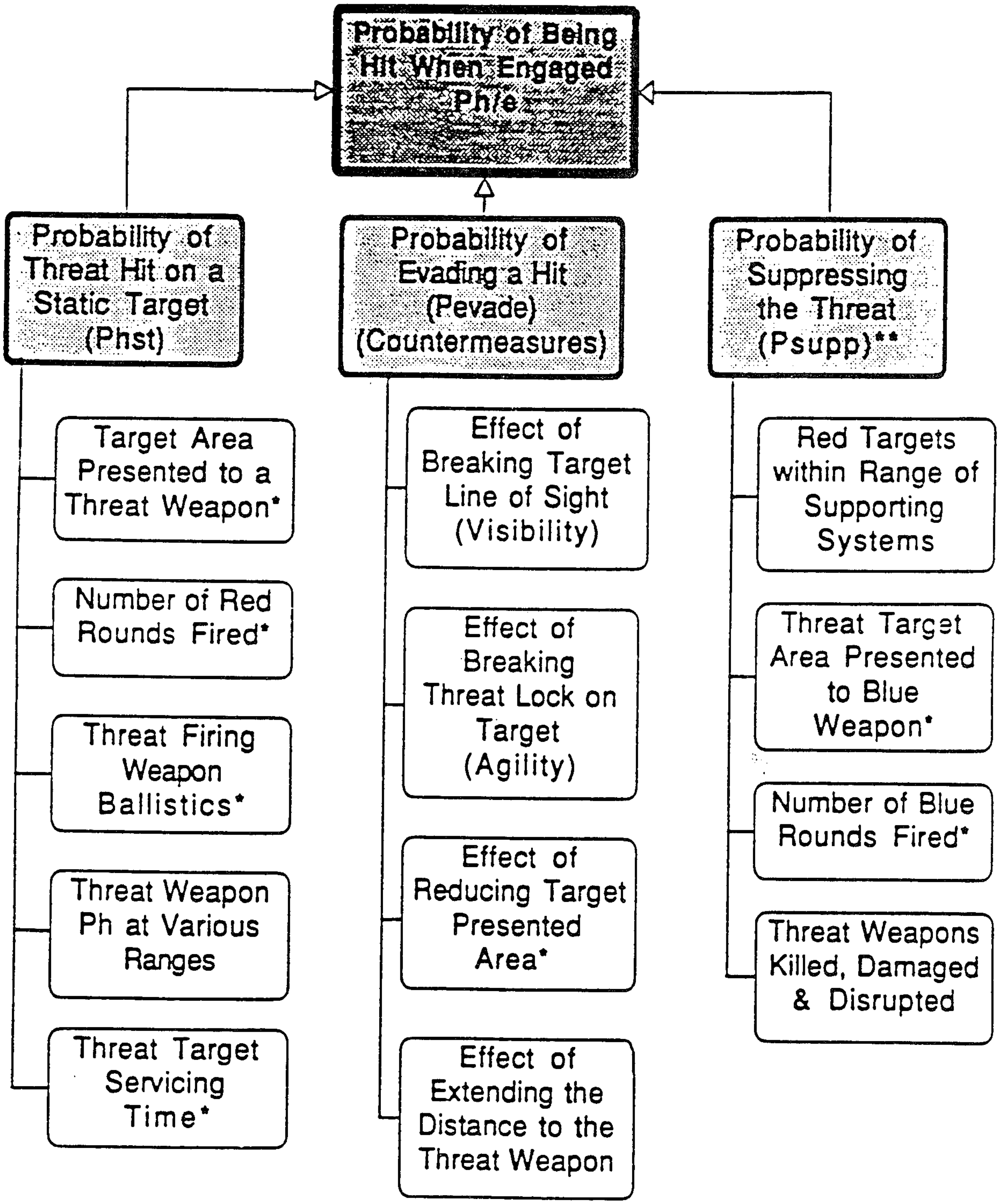


Figure 14-2. Possible Factors Impacting the Probability of Being Engaged

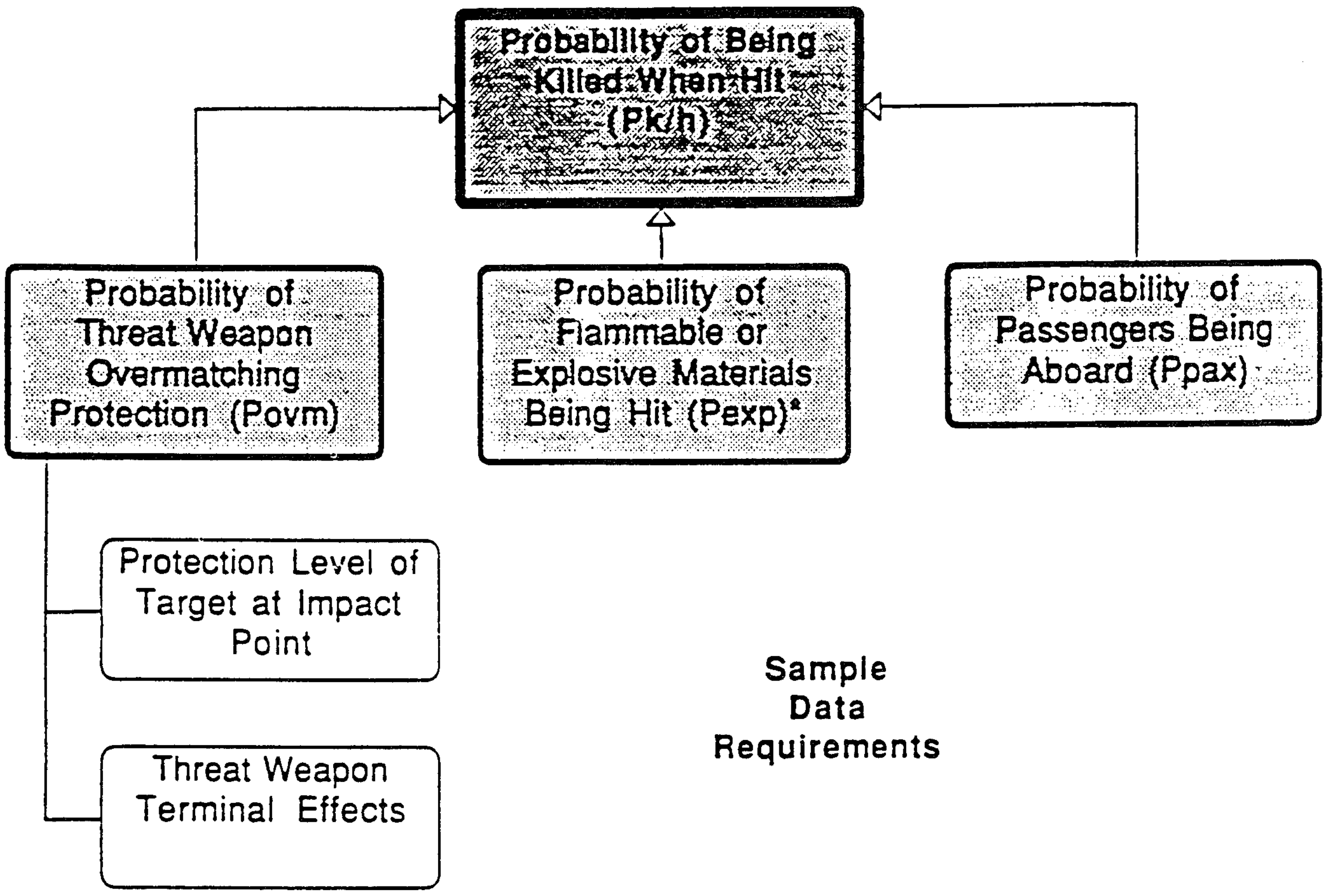
PROBABILITY OF BEING HIT WHEN ENGAGED



*Sample Data is Applicable Primarily to Ballistic Threats Against Conventional Weapons
**Overlaps with Mission Performance

Figure 14-3. Example Considerations for Estimating the Probability of Being Hit When Engaged

PROBABILITY OF BEING KILLED WHEN HIT



*Measure is applicable primarily to ballistic threats aginst conventional weapons systems.

Figure 14-4. Example Influences on the Probability of Being Killed When Hit

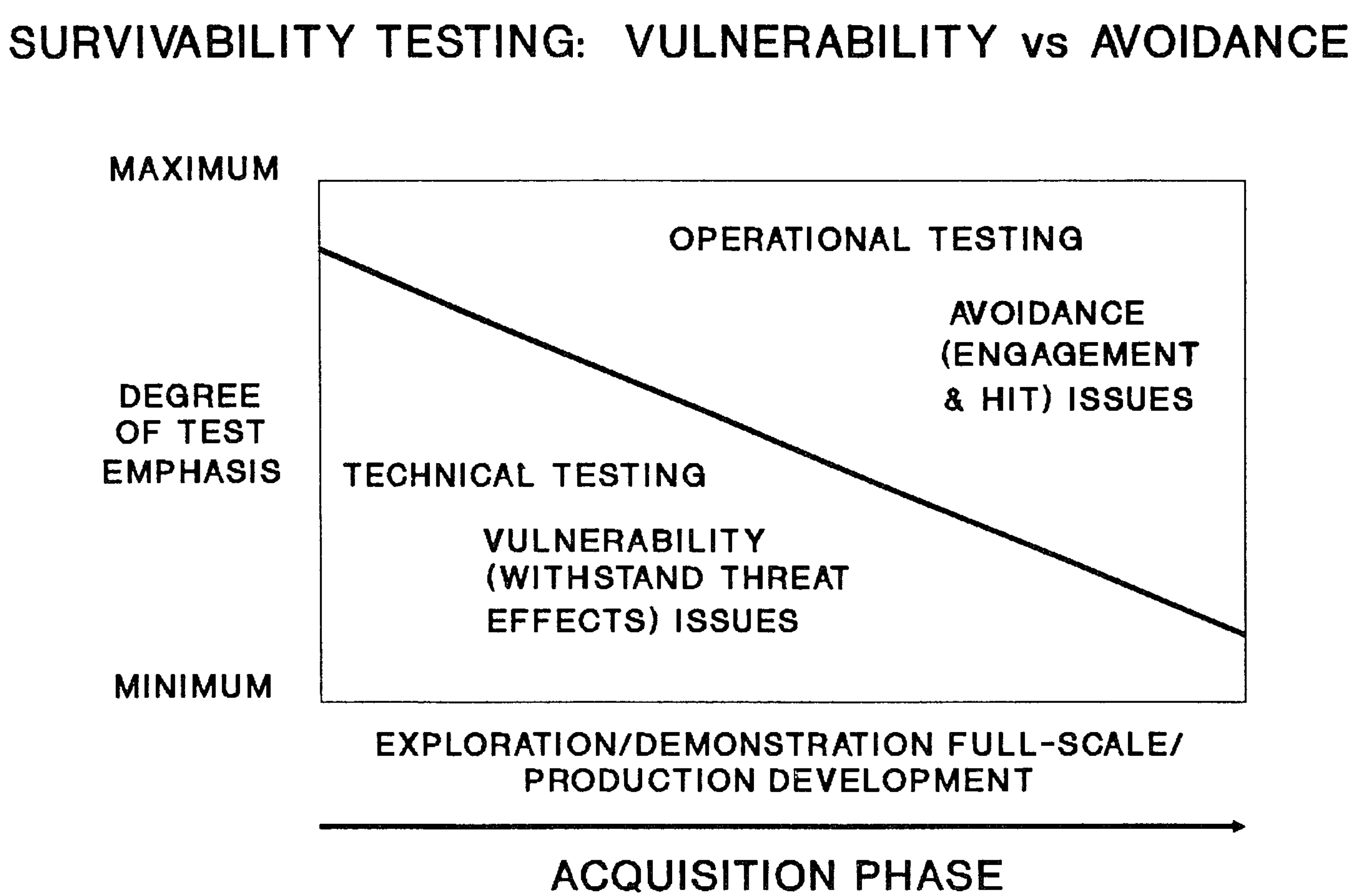


Figure 14-5. Survivability testing emphasis.

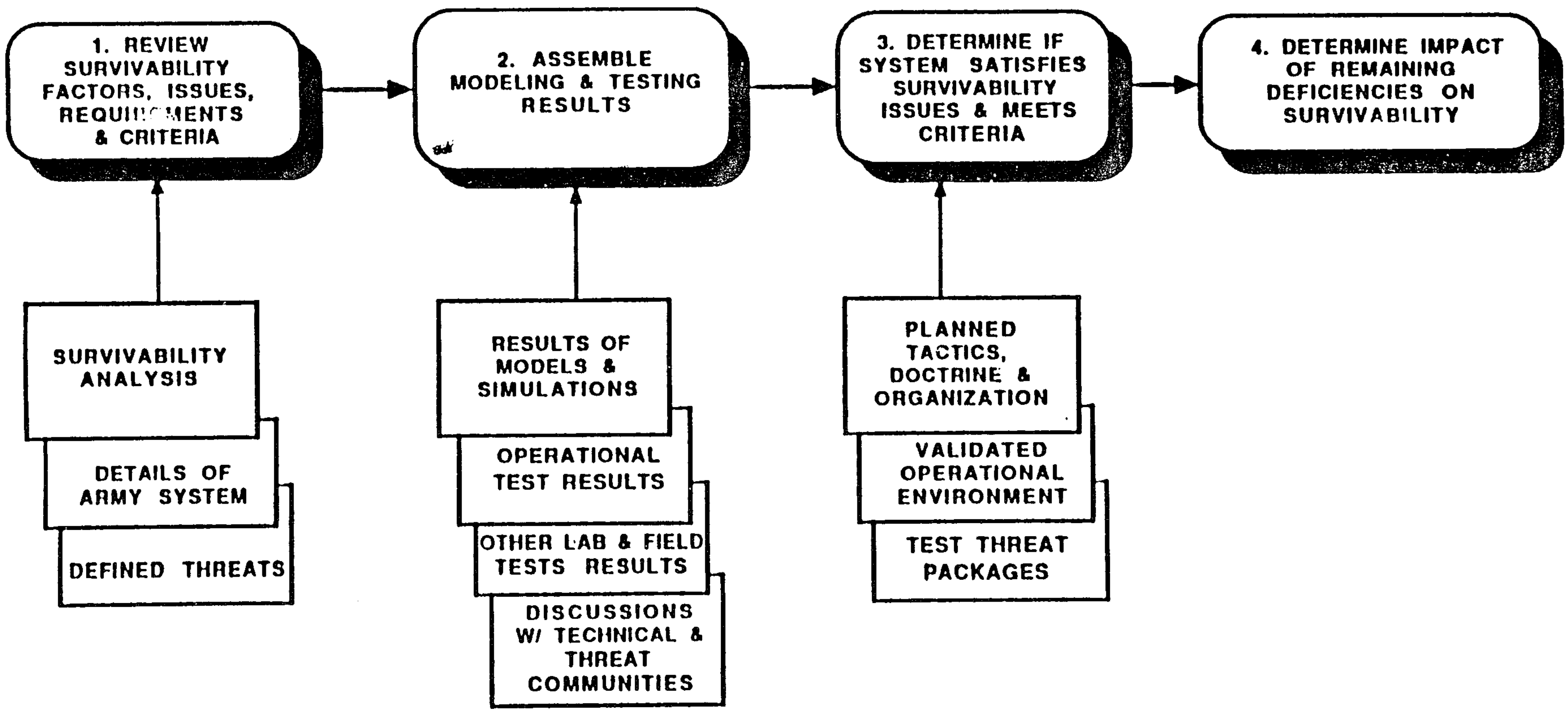


Figure 14-6. Survivability Evaluation Phases

Critical Issue: How well does the system operate in its intended E3 environment?

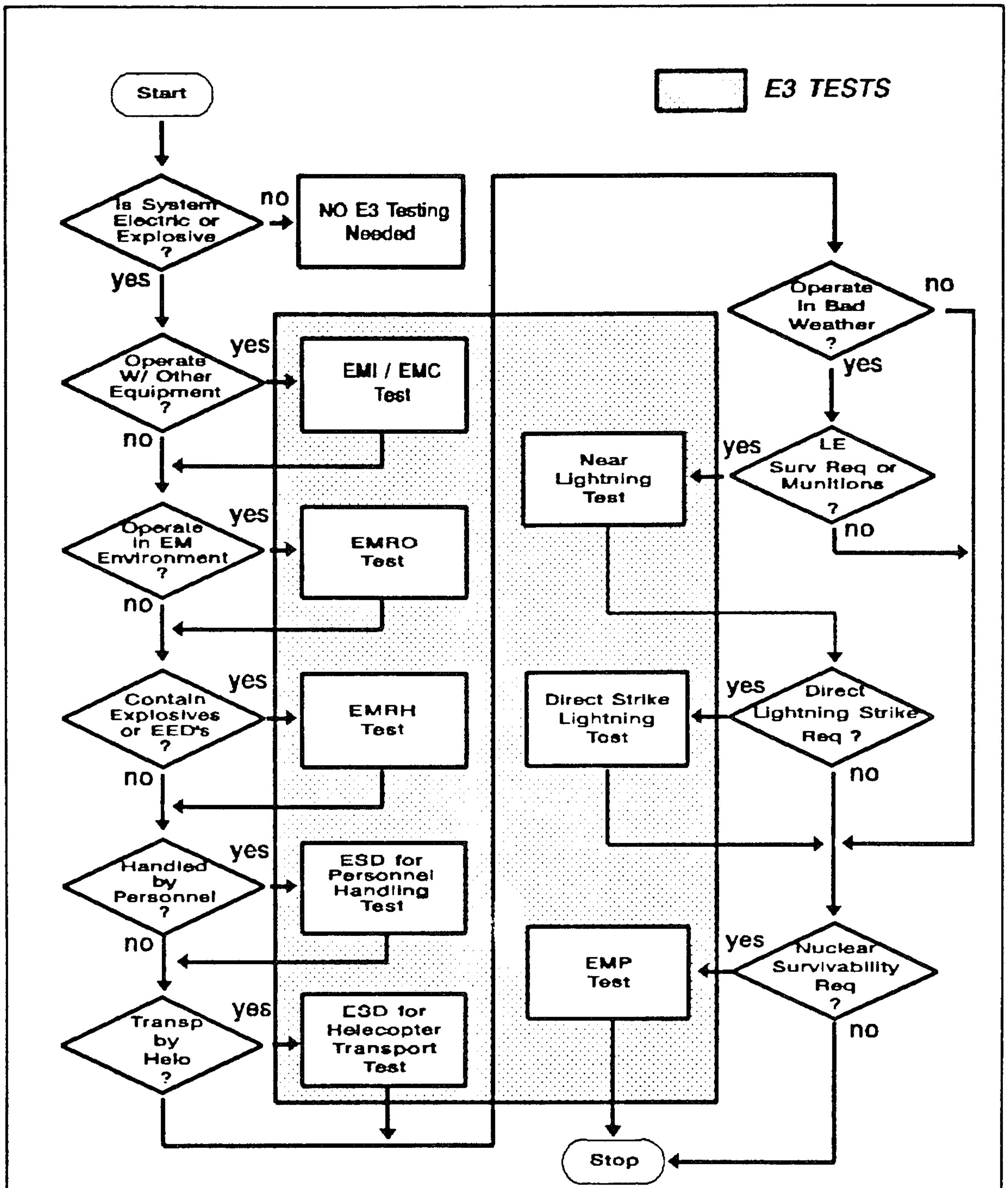
Scope: This issue will examine the effects of various Electromagnetic Environments (EME) on the ability of the system to be transported, stored, and operated. This issue is concerned with the effects of unintentionally-coupled EM radiation (as opposed to intentionally directed EM) that the system is expected to encounter. The E3 critical issue is comprised of six sub-issues:

- Electromagnetic Interference (EMI)
- Electromagnetic Radiation Operational (EMRO)
- Electromagnetic Radiation Hazard (EMRH)
- Electrostatic Discharge (ESD)
- Electromagnetic Pulse (EMP)
- Lightning Effects (LE).

Criteria: The system will comply with E3-related design standards/requirements, MIL-STD requirements as they pertain to the system, and the operational electromagnetic environment as determined by the E3 Requirements Board (E3RB).

Methodology: The system will undergo E3 testing to determine compliance. Anomalies will be assessed for their impact on the system's operation.

Figure 14-7. An example of an E3 entry in the AMSAA IEP



NOTE: If system is required to operate on board ship, add Naval shipboard EME to EMRO testing environment

Figure 14-8. E3 Test Selection Methodology

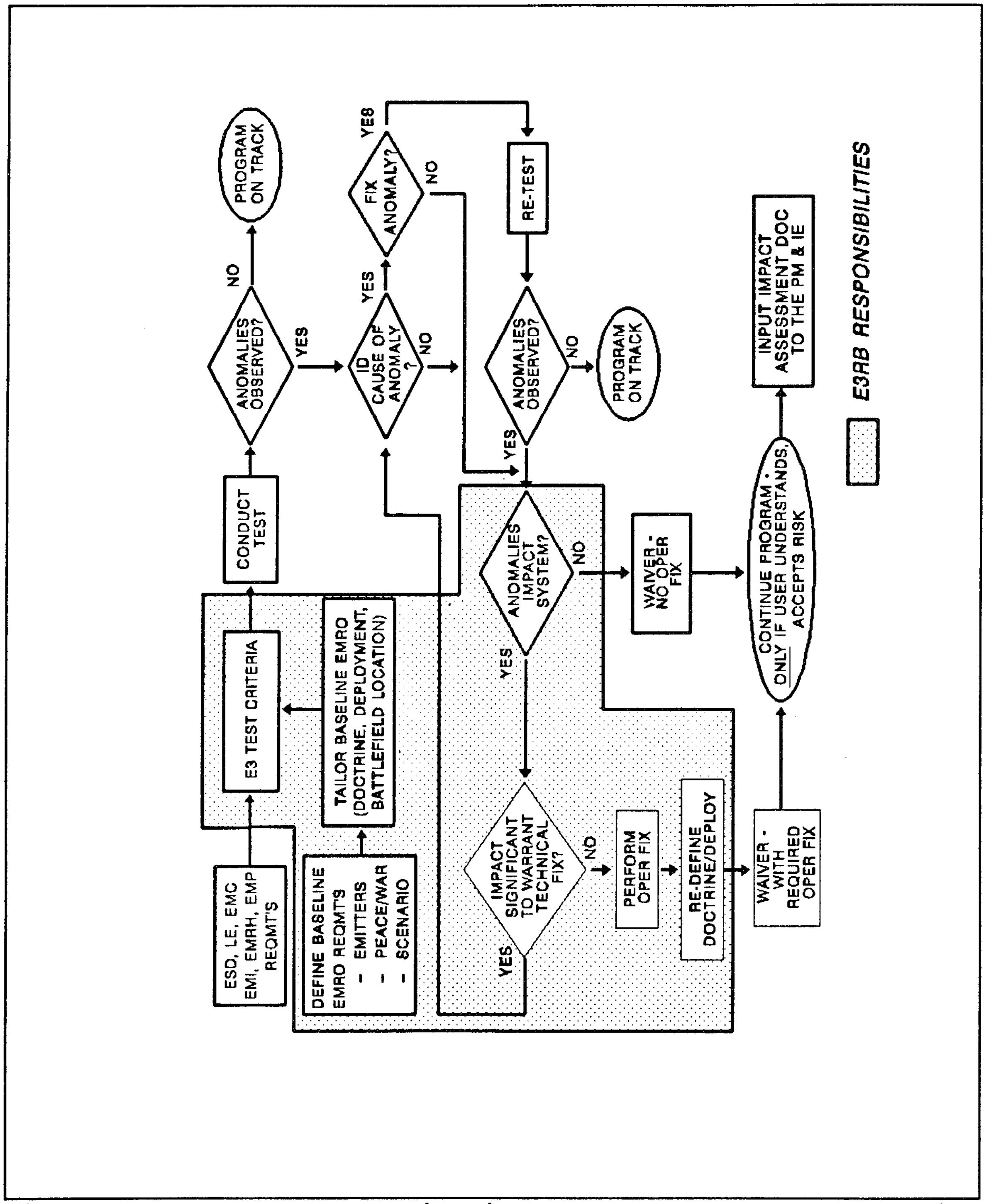


Figure 14-9. E3 Test Criteria, Test, and Test Evaluation Overview

FUNCTION	MEASURE
1. ABILITY TO AVOID BEING ENGAGED	One Minus The Probability Of Being Engaged [1-Pe]*
2. ABILITY TO AVOID BEING HIT WHEN ENGAGED	One Minus The Probability Of Being Hit When Engaged [1-Ph/e]
3. ABILITY TO WITH-STAND THREAT EFFECTS WHEN HIT (VULNERABILITY)	One Minus The Probability Of Being Killed When Hit [1-Pk/h]
4. ABILITY TO SURVIVE	One Minus The Product Of The Combined Probabilities Of Being Engaged, Hit, and Killed [1-(Pe times Ph/e times Pk/h)]

* Pe can be conceptualized as the appropriate combinations of factors such as the probabilities of detection; acquisition, given detection; location, given acquisition; and tracking, given location; combined with threat doctrine.

Table 14-1. Survivability Functions and Measures

SAMPLE ENGAGEMENT AVOIDANCE FUNCTION: FACTORS AND CONDITIONS

SECONDARY FUNCTIONS	SELECTED MOPs	FACTORS AND CONDITIONS		
		SYSTEMATICALLY VARIED	TACTICALLY VARIED	UNCONTROLLED
ELUDE THREAT DETECTION	• % of Force Detected • Mean Time of Detection • Mean Detection Range	• Dwell Times (Short, Medium, Long) • Movement Speed (Slow, Medium, Fast) • Exposure Time (Short, Medium, Long) • Distance from Threat (Near, Mid, Far) • Dispersal (Compact, Mid, Wide)	(attack, defend, delay) · Threat RSTA Capability(low, medium, high)	• Weather (Clear, Overcast, Inclement) • Motivation (High Average, Low)
CONFUSE & DELAY IDENTIFICATION	• % False Identifications • Mean Time to Identify	• # of Blue Systems (Few, Many) • # of Other Blue Targets (Few, Many) • Distance from Threat (Near, Mid, Far) • Terrain, Vegetation, Visibility	• Cam, Cov, Conceal Dev (Natural, Issued, Chem) · ECM (SED, IED, MED) • IRCM (flares, decoys)	• Weather (Clear, Overcast, Inclement) • Motivation (High, Average, Low)
PREVENT ACQUISITION	· % Blue Tested Systems Successfully Aquired • Mean Time to be Acquired	• # of Acquisitions at Various Ranges (Near, Medium, Far) • Terrain, Vegetation, Visibility	• Cam, Cov, Conceal Dev (Natural, Issued, Chem) • Maneuver (random, reactive, none) • IRCM (chaff, no chaff)	• Weather (Clear, Overcast, Inclement) • Motivation (High, Average, Low)
AVOID ACCURATE LOCATION	• Probability of Being Located within x Meters • Mean Location Error	• # of Moving Blue Systems(Few, Many) • # of Stationary Blue Systems (Few, Many) •Terrain, Vegetation, Visibility	• Deception (None, decoys, dummys) • ECM (SED, IED, MED, meacons)	• Weather (Clear, Overcast, Inclement) • Motivation (High, Average, Low)
ESCAPE & EVADE TRACKING	• Probability of Breaking Line-Of-Sight • Mean Duration of Track	• Blue System Speed (Slow, Med, Fast) • Distance from Threat (Near, Mid, Far) • Terrain, Vegetation, Visibility	• IRCM use (low, medium, high) •ECCM (halt emmissions - comms and non-comms)	• Weather (Clear, Overcast, Inclement) • Motivation (High, Average, Low)
SUPPRESS THREAT SYSTEMS (SUPPORTING BLUE SYSTEMS)	• % Threat Acquisition Systems Suppressed • Mean Duration of Suppression	• Distance from Blue Supporting System to Threat (Near, Mid, Far) • Exposure of Threat to Blue Support System (Low, Mid, High)	• Threat electronics Sys (jam, no jam) • Threat EO Links (jam,no jam) • Threat Lethal Systems(Supp by Blue air, arty)	• Weather (Clear, Overcast, Inclement) • Motivation (High, Average, Low)

Table 14-2. Sample Engagement Avoidance Factors and Conditions

Table 14-3
E3 Test Selection Methodology

PRIMARY E3 DOCUMENTS			
System	Aviation	General Information EMC/EMI EMV ESD Lightning NEMP (EMP) RADHAZ Tempest	ADS-37 ADS-37 ADS-37 ADS-37 ADS-37 ADS-37 ADS-37 ADS-37
	Non-Aviation	EMRO EMRH Lightning Static Electricity EMP	TOP-1-2-511 TOP-1-2-511 TOP-1-2-511 TOP-1-2-511 MIL-STD-2169 Q-STAG 244
Subsystem or Component	Aircraft	General Information Conducted Emissions Conducted Susceptibility Radiated Emissions Radiated Susceptibility	MIL-STD-461 MIL-STD-461 MIL-STD-461 MIL-STD-461 MIL-STD-461
	Ground Vehicles	General Information Conducted Emissions Conducted Susceptibility Radiated Emissions Radiated Susceptibility	MIL-STD-461 MIL-STD-461 MIL-STD-461 MIL-STD-461 MIL-STD-461
	Tactical or Special Purpose		MIL-STD-461
Ordnance			MIL-STD-1385B

Table 14-4. Army E3 testing capabilities.

TEST CAPABILITY SUPPORT MATRIX

	ORGANIZATION/ACTIVITY			
CATEGORY	CSTA	EPG	RTTC	WSMR (ARMTE)
EMC	M	M	M	M
EMI	M	M	M	M
EMRH		M	M	M
EMRO		M	M	M
EMV		M		
ESD		M	M	M
HERO			S	
LIGHTNING			M	

M = major capability S = supporting capability

Table 14-5

E3 ORGANIZATIONS/OFFICES

1 **AIR FORCE**

a. **Air Force Flight Test Center**
Benefield Anechoic Facility
Edwards AFB, CA 93523-5000
DSN 527-0840
FAX 805-277-5405

b. **Rome Laboratory**
E3 Research Center
ATTN: RL/ERPT
Griffiss AFB, NY 13441-5700
DSN 587-2841
FAX 315-330-7083

c. **Air Force Developmental Test Center**
Guided Weapons Evaluation Facility
CDR 3246 Test Wing/TFG
Elgin AFB, FL 32542-5000
DSN 872-9798
FAX 904-882-9929

d. **Air Force Developmental Test Center**
Preflight Integration of Munitions and Electronic Systems
CDR 3246 Test Wing/TFP
Elgin AFB, FL 32542-5000
DSN 872-9354
FAX 904-882-9357

2 **ARMY**

a. **Test and Evaluation Command**
Combat Systems Test Activity
ATTN: STECS-EN-EI
Aberdeen Proving Ground, MD 21005
DSN 298-3510
FAX 410-278-7700

b. **Armament RD&E Center**
Electromagnetic Systems Section
ATTN: SMCAR-AEC-IE
Picatinny Arsenal, NJ 07806-5000
DSN 880-3025
FAX 908-724-5861

c. **Test and Evaluation Command**
Electronic Proving Ground
ATTN: STEEP-MT-E
Ft. Huachuca, AZ 85613-7110
DSN 879-4862
FAX 602-538-4933

d. **Test and Evaluation Command**
Redstone Technical Test Center
ATTN: STERT-TE-E-EM
Redstone Technical Test Center
Huntsville, AL 35898-8052
DSN 788-2952
FAX 205-842-9637

e. **Test and Evaluation Command**
White Sands Missile Range
ATTN: STEWS-TE-AG
White Sands Missile Range, NM 88002-5157
DSN 258-2935
FAX 505-678-3261

3 **NAVY**

a. **Naval Air Engineering Center**
ATTN: CODE 545
Lakehurst, NJ 08733-5112
908-323-7050

b. **Naval Air Test Center**
ATTN: CODE SY80EE
Patuxent River, MD 20670
DSN 356-4681

c. **Naval Air Weapons Center**
Weapons Division
CDR NWC
ATTN: CODE 36254
China Lake, CA 93555-6001
DSN 437-2948

d. **Naval Command, Control and Ocean Surveillance Center**
ATTN: CODE 825
San Diego, CA 92152-5081
DSN 553-5081

e. **Pacific Missile Test Center**
CDR PMTC
ATTN: CODE 4034
Point Mugu, CA 93042-5000
DSN 351-7884

f. **Naval Surface Warfare Center**
ATTN: CODE H 22
Dahlgren, VA 22448-5000
DSN 249-8594

Chapter 15
Compatibility and Interoperability

15-1. General
The purpose of this chapter is to describe the procedures necessary for effective Operational Test and Evaluation (OT&E) of the compatibility and resulting interoperability of developing weapon systems. It defines compatibility and interoperability (C&I), outlines procedures for monitoring compatibility testing prior to User Test (UT), and defines the procedures for determining the elements of compatibility and the impacts of interoperability which require evaluation in OT&E. This chapter deals with system C&I pertaining only to communications and electronic functions or elements. Physical compatibility (e.g., do trailer hitches match) is normally covered under mission performance. Compatibility related to logistical support is covered as part of logistics (see chapter 10). C&I definitions are covered in Figure 15-1.

(INSERT FIGURE 15-1)

15-2. Operational evaluator involvement in system development

a. Objective. The operational evaluator monitors C&I requirements development early in the acquisition process and monitors technical testing as the system matures. Through this effort a determination is made on:

(1) The adequacy of C&I testing prior to UT.

(2) If there are any compatibility issues that make it inappropriate to go to UT.

(3) If identified C&I deficiencies need to be included in the TEP for UT.

(4) If special facilities, instrumentation, and simulators for C&I are required for UT.

b. Principal sources of information. The independent operational evaluator reviews the major documents which define the system's compatibility and interoperability environment and monitors the major events which produce information on C&I. He also reviews reports prepared by the developer or contractor and attends, when specifically required, management and coordination meetings (such as design reviews and TIWGs) where C&I problems or progress is reported. The following are the potential sources of

compatibility and interoperability information:

(1) Army Battlefield Interface Concept (ABIC). The ABIC is produced by the Combat Developer (CBTDEV) (usually TRADOC) and identifies the intra-Army, inter-service, and NATO systems architecture and associated interfaces. It serves as the primary document which defines the systems with which a developing system is expected to operate.

(2) User Interface Requirements (UIRs). The UIRs are the documents developed by the CBTDEV which identify the type, quantity, format, and frequency of the data to be exchanged. A UIR is developed for each pair of interfacing systems and serves as the primary document defining the users' requirements of the interface.

(3) Technical Interface Design Plans (TIDPs). The TIDPs are the technical design documents for each interface. They are developed by the Materiel Developer (MATDEV) and provide the technical interface parameters, message formats, message content, and implementation requirements.

(4) Interface specifications. Interface specifications are developed by the MATDEV and provide detailed technical engineering information on system interfaces.

(5) Interface Control Documents (ICDs). ICDs are developed by the MATDEV and describe the physical and electrical connections, voltage, and current requirements, and provide interface control drawings. Again, ICDs are not a primary source for operational evaluation.

(6) Interface operating procedures (IOPs). IOPs are developed by the MATDEV and describe the man-machine interfaces and standardized operating procedures for multiple interfacing systems. For NATO system interfaces, interoperability is guided by Standardization Agreements (STANAGS).

(7) Operator and User Handbook. Operator handbooks are developed in parallel with the system by the MATDEV in coordination with the user, and provide SOPs and user procedures relevant to the operation of the system.

c. Facilities, instrumentation, and simulators. As the above documents are being developed by their proponent and reviewed by the independent evaluator, development of the OT&E input to the Test and Evaluation Master Plan (TEMP) is taking place. A primary focus of this effort is the identification of facilities,

instrumentation, and simulators necessary for OT&E in general and C&I in specific. Facilities, instrumentation, and simulators necessary to test and evaluate C&I are long lead time items and require this advanced planning. Simulators, dynamic scenario stimulators, special instrumentation, and coordinating capabilities at multiple locations may be required and need to be identified early by the operational evaluator. Review of the above documentation and early development of a TEP provide the vehicle for this early planning. Required facilities and instrumentation are reflected as early as possible in the TEMP and Outline Test Plan (OTP).

d. Adequacy of the scope of technical testing. In order to monitor the depth and breadth of compatibility testing prior to UT, the independent operational evaluator implements the following process for tracking the factors and conditions, related interacting systems, and types of compatibility which require testing or other form of evaluation. The Operational Requirements Document (ORD) and ABIC enable the independent operational evaluator to identify the interfacing systems and the systems for which interface is a concern. The ORD and UIRs are used to identify the factors and conditions which have the potential to impact system C&I. Examples of these factors and conditions are shown in Table 15-1. Compatibility issues are identified by the evaluator based on review of the UIRs and the description of the environment from the ORD. Examples of compatibility considerations are listed in Table 15-2.

(INSERT TABLE 15-1)

(INSERT TABLE 15-2)

(1) The Evaluation Adequacy Matrix. An Evaluation Adequacy Matrix as illustrated in Figure 15-2 assists the independent operational evaluator in planning for and determining the extent to which technical testing has validated system compatibility. The types of compatibility, factors and conditions impacting C&I, and interfacing systems or equipment types are organized as shown in Figure 15-2. Results of technical testing are tracked by coding the cells to indicate whether testing has validated compatibility under the specified cell conditions or whether further testing is required. The completed matrix supports the assessment presented at the OTRR, of whether prior technical testing has comprehensively validated compatibility. If the testing has been inadequate or has identified any critical problem areas affecting the OT&E, appropriate adjustment to the Test and Evaluation Plan (TEP) or Detailed Test Plan (DTP) is made. When appropriate,

compatibility is further explored in UT.

(INSERT FIGURE 15-2)

e. Joint Tactical Command, Control, and Communications Agency (JTC3A). Joint testing of C&I is managed by the JTC3A with principal assistance by the Joint Interface Test Force (JITF) and the Joint Test Element (JTE) of JTC3A at Fort Huachuca, Arizona. Joint testing may also be tasked to one of the services. JTC3A and its sub-elements concentrate on the joint aspects of C&I and on interoperability certification. JTC3A has been assigned responsibility by DOD Directive 5154.28 for the development and maintenance of a joint architecture, interface standards, and interface definitions for joint or combined tactical C3 systems. The JTC3A is also responsible for developing, testing, and maintaining interface standards to be used by tactical C3 systems in joint or combined interfaces in accordance with guidance provided by JCS and OSD, and verifying that such systems have properly implemented the approved interface standards. JTC3A is a source of information for the evaluator when joint testing has been conducted.

15-3. Planning for C&I in OT&E

a. Evaluation Planning. C&I testing is planned and executed according to procedures described in the chapters on user testing. It involves the identification of C&I issues, Measures of Performance (MOPs) and Data Requirements (Drs). Principal issues for C&I are stated in the Mission Needs Statement (MNS), TEMP, and Test and Evaluation Plan (TEP). MOPs and Drs are developed using the dendritic approach. Figure 15-3 is a typical dendritic diagram for evaluation of compatibility. The compatibility functions, measures of performance, and data requirements are developed by the evaluator in a manner similar to that illustrated. Figure 15-4 is a dendritic applying to interoperability. The measures and data relate to the ability of the interfacing systems to exchange useful information and use the exchanged information effectively. Interoperability issues, MOPs, and Drs are modified by lessons learned in technical testing.

(INSERT FIGURE 15-3)

(INSERT FIGURE 15-4)

b. MOPs. MOPs for compatibility focus upon the operational requirements for exchange of signals and data in the proper format and at required rates within acceptable levels of error

detection and correction. C&I data elements are planned in the user test concept as an integral part of the user test trials. In some cases, the user test concept contains provisions for special trials or side tests which are required to capture specific data not collectable in standard scenarios. Outstanding operational C&I issues may require technical data (e.g., traffic volume, and error rates) to support their assessment. Most operational C&I issues, however, are resolved by evaluating the interoperability impact rather than testing the technical performance characteristics.

c. Test planning. Compatibility and interoperability planning is refined and implemented in the TEP and the DTP. If compatibility issues are included in the TEP, details of test planning may need to be derived from technical interface specifications developed by the materiel developer. Unresolved compatibility issues are included as test objectives in the UT. The test design topics addressed below are included as part of the scenario planning and test control planning in both the TEP and DTP.

(1) Communications. There are two types of communications associated with C&I testing: those necessary to manage and control the test process and those interoperable communications to be evaluated.

(a) Test management and control. Test management and control communications provide for equipment set-up and checkout, simulation and scenario execution, and control of the C&I testing process. Additional data communications and data quality lines may be necessary for data collection, data reduction, and quick-look analysis.

(b) Interface communications. The interface communications for the component systems being evaluated are to correspond to the level of testing. Communication circuits to be used during the test are to be engineered to insure technical requirements are met for data transfer speeds, signal levels, circuit type, line terminations and security requirements.

(2) System certification. Individual Services are responsible for insuring that the technical and procedural interfaces between tactical command and control systems, communications systems, communications equipment, and tactical C3 systems and Intelligence systems, comply with the interface documentation. The operational evaluator insures that certification testing has been done and reflects this in the evaluation.

(3) Scenario generation and execution. The user message exchanges are executed in accordance with the test scenario to insure correct receipt and proper response to all messages transmitted. Simulation and stimulation may be required to exercise fully the total interoperability of the interfacing systems. When scenario stimulators are used, events and associated responses are defined using the procedures contained in operator handbooks and Interface Operating Procedures documents.

(a) Scenario generation. During test planning and execution, communications and environmental simulation capabilities require integration with test events or tactical scenarios. Scenario drivers provide the capability to generate, execute, and record test scenario execution. Environmental simulation systems provide a computer-aided capability for preparation and generation of test scenarios representative of the Army operational environment. Simulation systems provide the capability to specify and initiate events, a real-time monitoring capability, an on-line scenario modification capability, and a capability to collect all outputs of the simulation system. Use of such scenario drivers and simulators is often required in user test of interoperable systems.

(b) Scenario execution, monitoring, and control. The data collection capability provided by automated simulators and scenario drivers augments the post-test analysis effort. During user testing, exchange of data between test systems is monitored to insure that test procedures are executed as required and that a preliminary assessment of test results is possible. A test monitoring system provides a computer-assisted capability to monitor the exchange of data and information within an interface in reaction to simulated test stimuli. These systems allow the test directorate to monitor the real time progress of developing scenarios, observe actual interface status (in real time) as it relates to the scenario, tailor the scenario to each situation, analyze system reaction to stimuli, analyze system reaction to the operational scenario and record data for subsequent playback, reduction, and analysis.

(4) Data collection. A data recording capability is often required to collect the amounts and types of test data required to support the field operations, stimulation, simulation, monitoring, and analysis functions. Automated data recording is used to the maximum extent possible. When feasible, the user tester plans for the capability to playback the recorded data for post-test analysis or data reconstruction. Early and repeated coordination with instrumentation support sources is required to ensure efficient data collection. Test Directorate and Data

Collection Team coordination provides the capability for as-required modification of standard collection requirements.

(5) Data exchange. With the physical and electrical interfaces established, data from UT are collected to confirm the capability of the systems to exchange the required data in the correct form without unacceptable error. Data exchange encompasses user data (messages) using the required formats and transfer protocols.

(6) Data reduction. Automated data reduction will receive the recorded data in the form of voltages, signals, frequencies, messages transmitted and received, operator actions, associated time, and scenario events. These data are refined and provided to the evaluator in formats suitable for evaluating the C&I performance related to the test issues. Manual data reduction usually is associated with the subjective reports, critiques, and Test Incident Reports (TIRs) generated by the test and evaluation personnel as well as from post-test debriefings. The data are reviewed, abstracted, and sorted in accordance with the DTP.

15-4. Interoperability evaluation

a. Interoperability benefits. Interoperability benefits typically manifest themselves in improvements to system performance metrics. Decreased time to perform a function, increased number of target opportunities, and more precise or timely information are examples of how interoperability can be quantified. These metrics are often expensive in that they require a base case against which to measure the increase or decrease in performance.

b. Interoperability burdens. Interoperability also manifests itself in a negative way by increasing the time required to begin or complete missions. In addition, interoperability may require the handling and transport of additional equipment, as well as extra operators and maintainers. The evaluator quantifies these effects and uses the metrics produced to provide a value judgment on the operational effectiveness of the system. When appropriate, attention is given to the time to restore lost interoperability and the impact of the loss. As interoperability is often provided among a large number of systems, the evaluation adequacy matrix described in paragraph 15-2d(1) of this chapter is used to identify potential problems areas.

Compatibility. Compatibility is defined by JCS Pub 1 as the capability of two or more items or components of equipment or materiel to exist or function in the same system or environment without mutual interference. For data and communications systems, compatibility describes whether systems have the technical capability to interface and exchange data. Compatibility is tested and evaluated extensively during technical testing and to a lesser extent in user testing. The independent operational evaluator monitors technical testing to validate system compatibility and to identify problems relevant to or impacting on the anticipated OT&E. Compatibility is addressed in terms of electrical (or electromagnetic), physical and man-machine interfaces and in terms of mutual interference. Compatibility concerns also apply to the instrumentation and automation support plans as well as the tested system.

Electrical and Electromagnetic Compatibility. Electrical compatibility involves voltage (110V, 220V), current (AC/DC), and for alternating current, frequency (60 Hz, 400 Hz, etc). Electromagnetic compatibility encompasses the interconnecting medium for systems not physically connected by wire or cable. For radio and visible light interfaces the basic consideration is the frequency of the transmitted signal. Other factors which are considered include bandwidth, frequency hopping patterns, and signal polarization.

Physical Compatibility. Physical compatibility involves the interconnecting wires, cables, and mechanical linkages. For example, the connectors of interconnecting cable must fit the outlets on the equipment. The general considerations of physical compatibility are not addressed in this chapter, but are included in the area of system performance.

Man-Machine Interface Compatibility. Compatibility also includes man-machine interfaces. These interfaces are part of MANPRINT evaluation.

Mutual Interference. Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) are other aspects of compatibility which address the extent to which a system's performance is degraded by its proximity to another system. EMC and EMI are evaluated for their impact on the electromagnetic transmissions of multiple interfacing systems as well as their impact on friendly systems for which interfacing is not intended. Specifically, if two systems having electrical transmissions are not integrated and are brought together in the field, then consideration of their mutual operation in the presence of each other is addressed in EMC. EMI addresses interference of components within the same system.

Figure 15-1. C&I TERMINOLOGY.

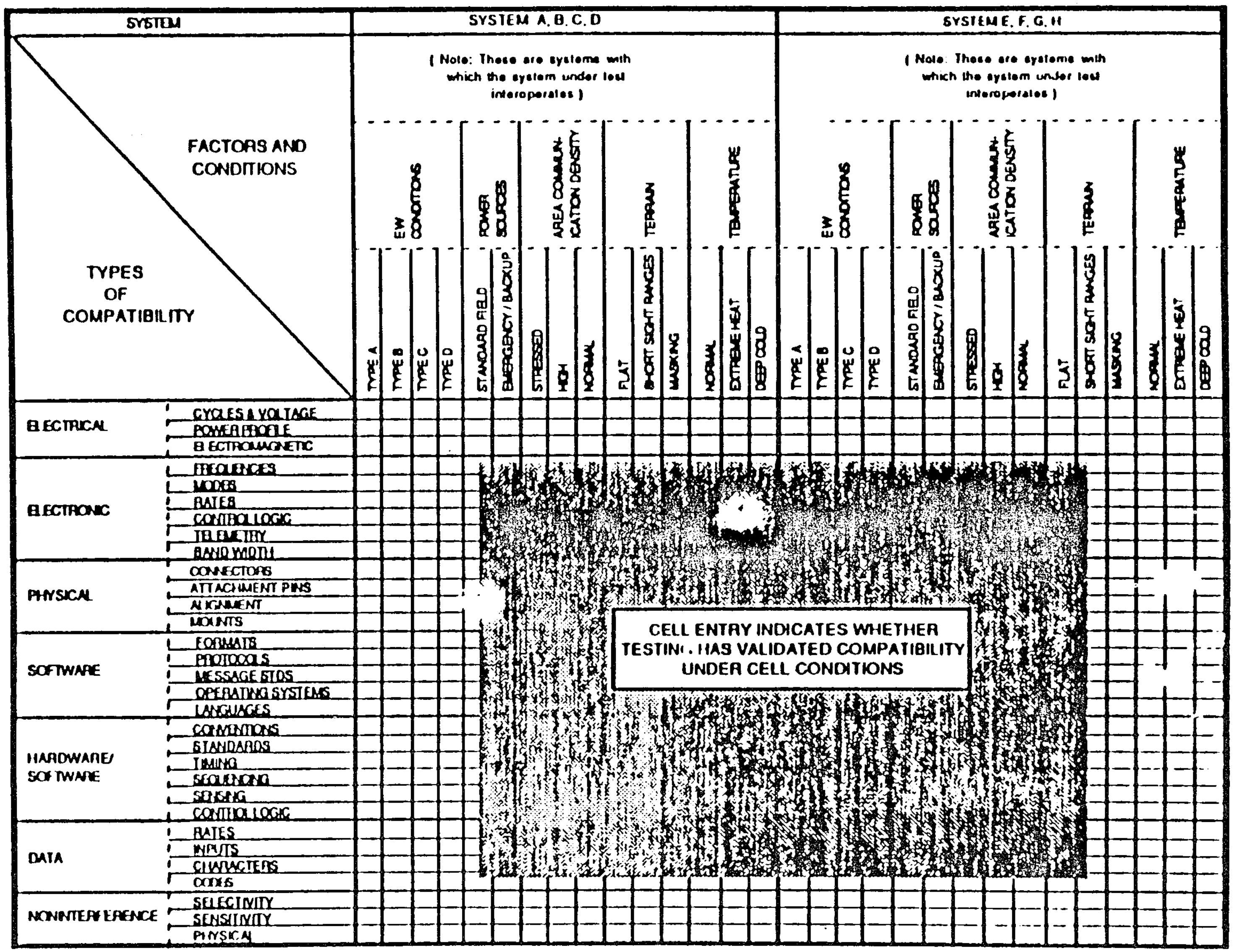


Figure 15-2. Notional Evaluation Adequacy Matrix

COMPATIBILITY DENDRITIC

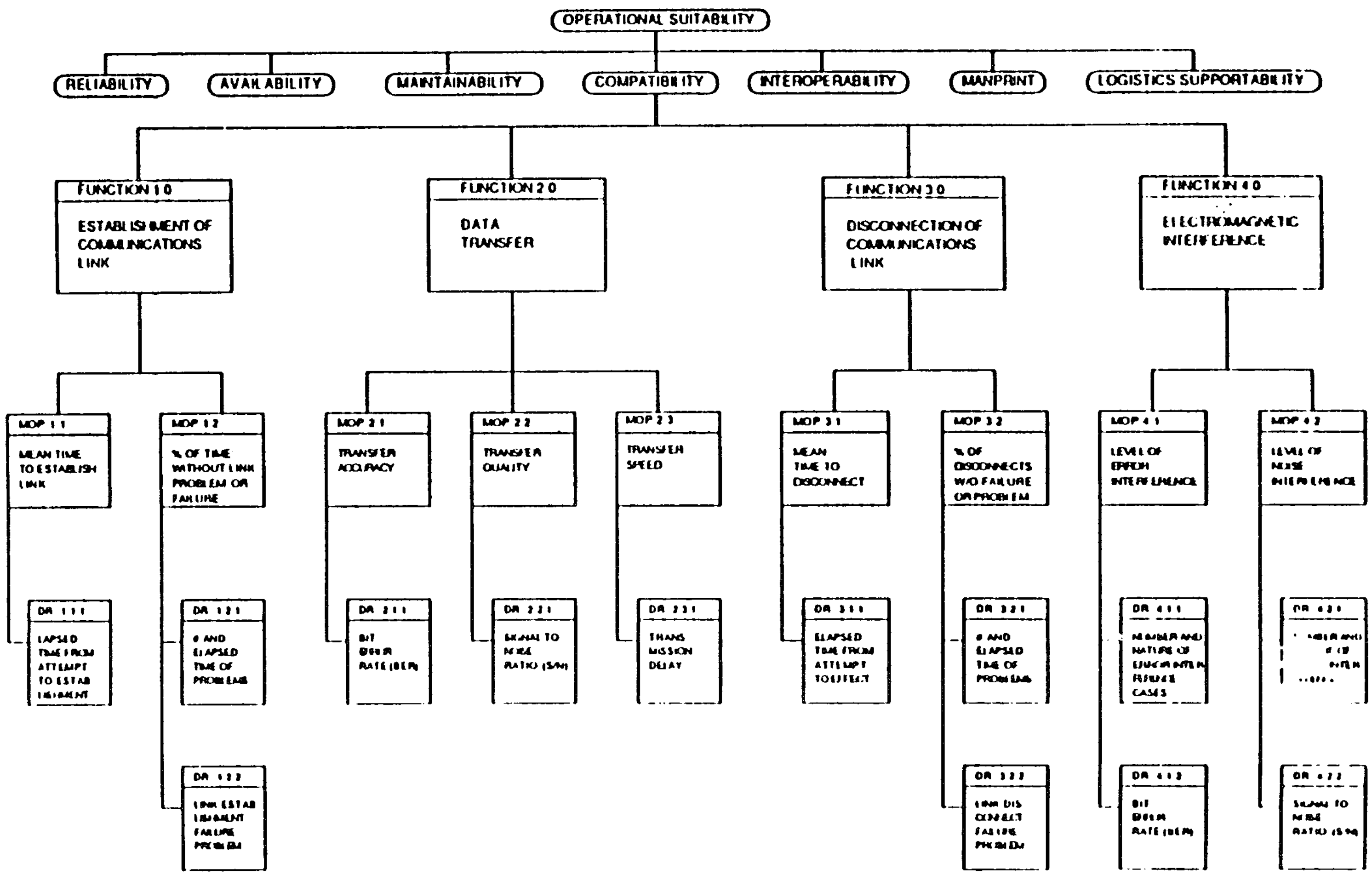


Figure 15-3, Compatibility Dendritic

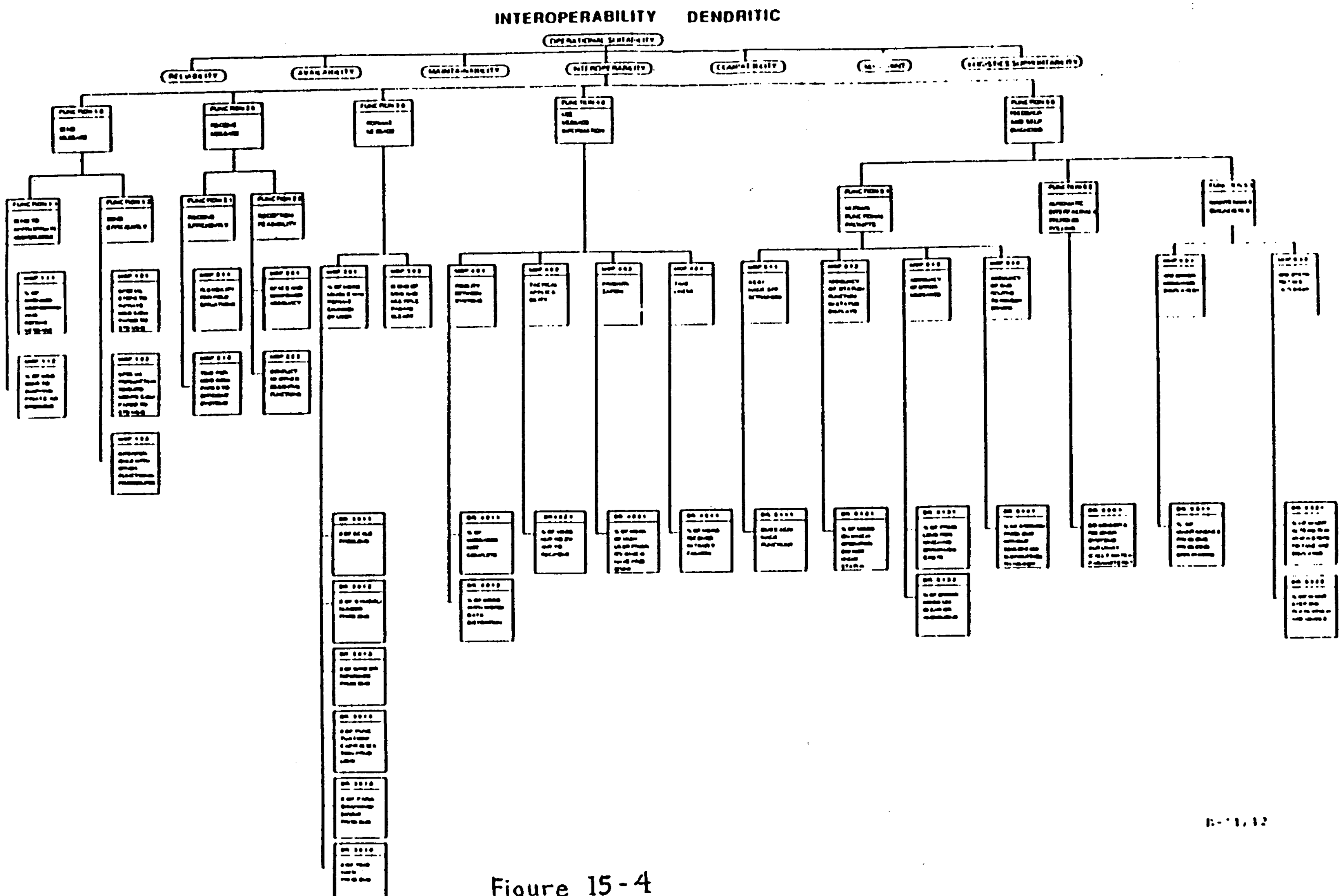


Figure 15-4

FACTORS AND CONDITIONS	NOTIONAL LEVELS OR OPTIONS
WARFARE TYPE	• CONVENTIONAL • NUCLEAR • GUERR!
MOBILITY REQUIREMENTS	• STABLE • VOLATILE
NUMBER ON NET	• TWO • NO MORE THAN N
VEGETATION	• OPEN • WOODED/DENSE
MISSION	• OFFENSE • DEFENSE • RETROGRADE
VISIBILITY	• CLEAR • OBSCURED
OBSTACLES/INTERFERENCE	• AIRCRAFT • SHIP • RAIL
TRAINING LEVEL	• UNTRAINED • AVERAGE • HIGH
WEATHER	• CLEAR • OVERCAST • PRECIPITATION
TERRAIN	• FLAT • ROLLING HILLS • MOUNTAINOUS
CLIMATE	• TEMPERATE • DESERT • ARTIC
OPERATIONAL INTENSITY	• LOW • HIGH
THREAT JAMMING INTENSITY	• LOW • HIGH
INTERFERENCE CONDITIONS	• JAMMING TYPES • WAVEFORMS • FRIENDLY EMITTERS
POWER SOURCES	• MIXED • EMERGENCY ALTERNATIVES
AREA COMMUNICATION DENSITY	• HIGH DENSITY • LOW DENSITY

Table 15-1. Sample Factor and Condition Variables

TYPE OF COMPATIBILITY	COMPONENTS
ELECTRICAL	• VOLTAGE • CYCLES • POWER PROFILE • ELECTROMAGNETIC
ELECTRONIC	• FREQUENCIES • MODES • RATES • CONTROL LOGIC • TELEMETRY
PHYSICAL	• ATTACHMENT PINS AND CONNECTORS • ALIGNMENT
SOFTWARE	• FORMATS • PROTOCOLS • MESSAGES
HARDWARE/ SOFTWARE	• CONVENTIONS • STANDARDS • TIMING • SEQUENCING • SENSING • CONTROL LOGIC
DATA	• RATES • INPUTS • CHARACTERS • CODES

Table 15-2. Notional Types of Compatibility

Chapter 16
Modeling and Simulation in Support of Test and Evaluation

Section I
Overview

16-1. Purpose/Scope

a. DODM 5000.2-M, Part 7 suggests the use of models and simulations in test and evaluation (T&E). Modeling and simulation (M/S) will be considered to support the developmental and operational T&E of software and systems as they proceed through the life cycle. Use of M/S will include, but not be limited to, the identification of test parameters and drivers for field tests; determination of high risk areas; prediction of test results; assisting in the allocation of scarce test resources; and the assessment of system capabilities in situations which cannot be tested due to safety, cost, or other constraints. Simulators, emulators, drivers, and stimulators (SEDS) which are used to fully work load a system under test are also included. Simulators are not to be confused with threat simulators which are covered in Part VIII. The extent of the use of M/S; whether existing M/S will ever be used or new M/S will be developed; status of M/S verification, validation, and accreditation (VV&A); and the degree to which M/S will augment test data to assist in system evaluations and assessments will be documented in the Test and Evaluation Master Plan (TEMP). Models and simulations used for T&E must be accredited and validated prior to their use for extrapolation or predicting system performance (including software, hardware, man-in-loop). Software T&E procedures are documented in Part Seven.

b. This chapter provides background on the use of models and simulations, simulators, emulators, drivers, and stimulators to support or supplement T&E. It addresses requirements and opportunities for the use of models and simulations in conjunction with both developmental and operational testing. It addresses a wide range of modeling activity from engineering models through item level performance models to force on force models. Table 16-1 identifies organizational points of contact for the various levels of models to be considered in test and evaluation and simulation support.

(INSERT TABLE 16-1)

Section II
General

16-2. Background

a. Testing is conducted due to the requirement for realistic and effective evaluations of Army system acquisitions. Effective evaluations are required by the decision maker to support decision making within the acquisition cycle. T&E are interrelated and complementary processes, both of which are necessary; however, neither process alone is sufficient. Evaluations judge overall system performance against technical and operational mission requirements and reassess performance as the mission requirements and system design evolve. The test results, among other sources of information, are an integral part of the evaluation. Analytical models and simulations are tools to assist these processes. A consistent and traceable set of tools should be used throughout the T&E process to help mitigate surprises encountered during testing or analysis of test results. The framework for the T&E process, including the use of M/S, should be documented and updated in the TEMP.

b. M/S will continue to be used extensively to support the weapon development T&E process which includes the software development T&E process. Army systems in development are increasingly complex. In addition, systems are required to operate in adverse environments (weather, hostile and benign electromagnetic, space, enemy countermeasures). To be effective, they must interact with other systems often over extended ranges. Development of advanced command and control (C&C) systems are required to overcome these difficulties. Furthermore, C&C systems now being developed are expected to be effective against future threats that are not fully predictable. An extensive test of such systems would be large in scope and require the duplication of conditions that are difficult if not impossible to create short of actual combat. The practicalities of cost, test range space, availability of advanced threat systems/surrogates, safety, etc., will necessarily limit test planning and test data availability. M/S provides an approach to address these limitations. Evaluation of a major system's performance may require a "model" to integrate the available test data and to extrapolate to those conditions which cannot be achieved due to test constraints and limitations in the test environment. These models and simulations are not replacements for testing, but rather complementary tools to assist in the evaluation process.

16-3. Types of Models Used

a. In the broadest sense, a model is a representation of an object, system, or process (or a part thereof) in mathematical, physical, or logical terms. It is usually simplified, often idealized or abstract, and serves as a basis for calculations, predictions or further investigations. Simulation is a technique for experimentation in which the operation and dynamics of a real-world system are represented by the exercise of some different system, usually involving one or more models. Under these definitions, a scaled representation of an aircraft is a model; placing that representation in a wind tunnel to study flight dynamics would be a simulation. The basic concept underlying these definitions is that a model is an abstraction that embodies our understanding of a system while a simulation represents the dynamic exercise of one model or a set of models.

b. The Army utilizes a wide range of types of models in the T&E process: 1.) engineering models; e.g., those that emulate every steering command sent to the control mechanisms of guided weapons, those that provide six-degree of freedom representations of weapon trajectories, those that address countermeasures by taking into account propagation characteristics of the atmosphere as well as target susceptibilities; 2.) hardware-in-the-loop simulations; e.g., those involving a marriage of developmental hardware and software and other equipment or stimuli with which the developmental system must be able to interact or function on the battlefield; 3.) battlefield environment models; e.g., those that represent natural and man-made aspects such as smoke, dust, and obscuration, those that estimate terrain effects on system mobility characteristics, those that estimate one-sided performance of a system, those that predict reliability and those that address supportability issues; 4.) combat models; e.g., one versus one models, such as duels between weapons or jammers against radars, force-on-force models, ranging in force size from several elements on each side to the corps level.

c. "Item level" models are generally one-sided, i.e., the effectiveness of a new tank may be characterized by representing its target acquisition and firepower capabilities versus threat tank attributes such as signature, size, speed, maneuverability, and protection. The survivability of the new tank might be examined by turning the one-sided model around and estimating the threat tank capabilities against the new tank attributes. Item level automotive performance models consider engine horsepower, vehicle weight, vehicle weight distribution, traction, and other attributes along with terrain characteristics to examine mobility. An item level model can draw upon engineering models for input, and it can then provide input to the lower resolution models in the hierarchy described above (i.e., duels and force-

on-force).

d. The analyses and evaluations that support the acquisition decision process usually include the use of force-on-force models that assist in the evaluation of the synergistic aspects of a developmental system's contributions to total force effectiveness, [e.g., a new counterbattery radar will be evaluated in a force-on-force model. The model accounts for the command, control, and communications links to both the counterfire weapons, and to other friendly elements that are supported by or protected by the developmental system. The model provides for equal representation of the threat force. The threat representation includes countermeasures that can jam the radar or its communications. Threat elements can detect and attack the radar and its command and control. The threat force will include a representation of its artillery capabilities versus the friendly force so that the developmental radar's contributions can be evaluated in terms of the survivability of the total force].

16-4. Applications of Modeling and Simulation

a. Support Evaluation/Test Design Planning.

(1) M/S can assist in the T&E planning process and can reduce the cost of the conduct of testing. Areas of particular application include scenario development; analysis of tactics and doctrine for systems; timing of test events; the development of objectives, essential elements of analysis, and measures of effectiveness; the identification of variables for control and measurement, training test participants in preferred tactics and doctrine, and the development of data collection, instrumentation and data analysis plans. For example; using M/S, the test designer can examine system sensitivities to changes in variables to determine the critical variables and the appropriate ranges of values to be tested. The test designer can also predict, prior to testing, the effects of various assumptions and constraints and can evaluate candidate measures of effectiveness to help in formulation of the test design plan.

(2) Caution must be exercised when planning to rely on M/S as a means of obtaining test data. M/S tend to be very expensive to develop. M/S results are difficult to integrate with data from other sources, and often do not provide the level of realism required from testing. Although M/S have these limitations compared to testing, they should be used, whenever appropriate, as another source of data for the evaluator.

(3) Computer simulations may be used to test the planning for a test exercise. By setting up and running the planned test exercise in a simulation, the timing of events and scenario may be tested and validated. The interaction of the various forces which test; the measures of effectiveness, the essential elements of analysis and, in turn, the test objectives may identify critical events. Further, the simulation may be used to verify the statistical test design, the instrumentation plan, the data collection plan, and the data analysis plan. Essentially, the purpose of the simulation in pretest planning is to preview the test exercise to make test planning more efficient. Pretest planning attempts to optimize test conduct by avoiding potential trouble spots and increasing the potential for efficient data collection.

(4) As an example of a simulation used in test planning, consider a model which portrays aircraft versus air defenses. The model can be used to replicate typical scenarios and provide data on the number of engagements, the air defense systems involved, the aircraft target, the length and quality of the engagement and a rough approximation of the success of the mission (i.e., did the aircraft make it to the target?). With such information available, a data collection plan can be developed to specify in more detail when and where data should be collected, from which systems, and in what quantity. The results of this analysis can be extremely useful in planning for long lead time items such as data collection devices and data processing systems. As tactics are developed and typical flight paths are generated for the scenario, an analysis can be performed on the flight paths over the terrain in question. A determination can be made whether or not the existing instrumentation can track the numbers of aircraft involved in their maneuvering envelopes. Trade-offs can be made between the amount of equipment to be purchased and the types of profiles which can be tracked for this particular test. Use of such a model can also highlight numerous choices available to the threat air defense system in terms of opportunities for engagement, and practical applications of doctrine to the specific situations.

b. Support Test Execution.

(1) Simulations can be useful in test execution and dynamic planning. With funds and other restrictions limiting the number of times that a test may be repeated and with tests sometimes requiring several days for completion, it is mandatory that the test director exercise close control over conduct of the test elements. This is to ensure that planned data are being gathered and to ensure adequate safety. The test director must

be able to make minor modifications to the test plan and scenario to adapt the test activities to changing circumstances. This calls for a quick-look analysis capability and a dynamic planning capability. Simulations may contribute to this capability, e.g., using the same simulation(s) as used in the pretest planning, the tester could input data gathered during the first day of the exercise to determine the adequacy of the data to fulfill the test objectives. Using these data, the entire test could be simulated to isolate and to modify the test plans to account for these projected inadequacies. Portions of the test could be deleted to save resources.

(2) Simulations may also be used to support test control and to assure safety, e.g., during missile test firings, aerodynamic simulations of the proposed test were run on a computer during actual firings so that real time missile position data could be continuously compared to the simulated missile position data. For example, if variations occurred beyond acceptable limits and if the range safety officer relinquished manual control, the computer could issue a command to destruct the missile.

(3) Simulations can augment test execution in order to reduce costs. For example, in air defense systems, missile fly-out simulations may be used in conjunction with system testing to reduce the expenditure of live missiles while providing information on overall system performance. Simulations can also be used to augment test execution by providing a means to simulate stress (or workload) to the system under test. For example, it may be prohibitive to set up a network of message traffic to adequately stress a communication system, but a simulation may be used to provide sufficient (simulated) message traffic to the system under test at a reasonable cost.

(4) Simulations can be used to augment tests by simulating non-testable events and scenarios. Although testing should be accomplished in as realistic an environment as possible, pragmatically, some environments are impossible to simulate for safety or other reasons. Some of these include the environment of a nuclear battlefield to include the effects of nuclear bursts on both friendly and enemy elements. Others include live firings of opposing forces and adequate representation of other forces to obtain compatibility and interoperability data. Instrumentation, data collection, and data reduction of large combined arms forces (e.g., brigade, division, and larger-sized forces) become extremely difficult to control and costly to execute.

(5) Usually, insufficient units are available to simulate

the organizational relationships and interaction of the equipment with its operational environment, particularly during the early OT&E conducted using prototype or pilot production type equipment. Simulations are not constrained by these limitations. Data obtained from a limited test can be used in more complex simulations to model scenarios involving the interaction of friendly forces against a variety of threat systems.

(6) Simulations can also play design characteristics of equipment and can be used to augment the results obtained using prototype equipment that is "mocked-up" to represent the final item. The simulation may be used to represent production level equipment in those areas where the prototype cannot meet production level performance.

(7) It is often necessary to use "substitute" systems in testing, e.g., an on-hand available system is used to represent the required system. The "substitute" system may have greater or less capabilities than the desired system. Simulations are capable of representing the actual characteristics of systems and, therefore, can be used as a means of modifying raw data collected during the test to estimate the required system characteristics. As an example, suppose the substitute system is an anti-aircraft artillery gun with a tracking rate of 30 degrees per second. The required system has a tracking rate of 45 degrees per second. A computer simulation could be used to augment the collected test data by estimating the number of rounds which would have been fired against each target or whether targets that were missed because of the slower tracking rate could have been engaged by the required system.

c. Support Analysis.

(1) Modeling and simulation may be used in post-test analysis to extend and generalize results and to extrapolate to other conditions. The cost and difficulty of controlling large test exercises, not to mention the difficulty in instrumenting them and collecting and reducing the data, to some degree limits the size of OT&E. This makes the process of determining the operational suitability of equipment to include compatibility, interoperability, organization, etc., a difficult one. To a large degree, the interactions, interrelationships, and compatibility of large forces may be obtained by using data collected during the test and playing it in a simulation.

(2) Simulations can be used to extend test results, save considerable test resources, and reduce test cost. This is accomplished by minimizing the need to replicate tests for the

improvement of statistical sample, determining overlooked or directly unmeasured parameters.

(3) During analyses the test results can be compared to the results predicted by the simulations used early in the planning process. Thus, the simulation may be validated by the actual live test exercise results, and the test exercise may gain credibility from the comparison with the simulation.

16-5. M/S in the Test and Evaluation Master Plan (TEMP)

a. During the test and evaluation planning process, both the tester and the evaluator determine to what degree M/S are necessary to supplement the T&E process and they forecast requirements for the use of M/S to support T&E of the system during the system's life cycle. Although some evaluations such as confirmation of critical technical and operational parameters are performed in a traditional testing environment, others such as safety, excursions, logistics support are conducted in a simulated or modeled environment. Development of the system's evaluation plan is often based on a trade-off analysis that identifies the appropriate, affordable evaluation tools (M/S and/or testing) to address the acquisition decision issues. Additionally, the evaluation plan should establish the complementary roles that M/S and testing will play to support the analytic process. The types of M/S, their applications, and their resource requirements are documented in the TEMP.

b. The TEMP defines and integrates the DT&E and OT&E efforts for all major weapon system procurements and related software development efforts. It relates program schedule, decision milestones, test management structure, and test resources to critical technical parameters, COIC, additional operational issues and criteria (AOIC), and T&E procedures. It is used as a tool for oversight, review, and approval of the test and evaluation effort by Office Secretary of Defense (OSD) and all Department of Defense (DoD) components. The TEMP, as described in DODM 5000.2-M, explicitly covers the system requirements, program summary, DT&E, OT&E, and test and evaluation process.

16-6. The Concept of Linkage

a. Decisions concerning the use of M/S should be made as early in the acquisition cycle as possible to support the timely development of any new modeling or any required upgrades to existing models. This requires early coordination (as soon as possible after Milestone 0)among the user, developer, testers and evaluators. Ideally, they will agree not later than Milestone I,

on the M/S needed to provide assessments for the systems. A plan should be developed at this time to transition the generic modeling capability specified at Milestone I to a mature, fully defined M/S requirement by Milestone II (for execution between Milestones II and III). In addition, data requirements and acquisition of input data for models are critical issues and are often long lead time items.

b. To ensure the validity of analyses used to evaluate capabilities in the context of complete force interactions and varying battlefield conditions, the models and computerized simulations upon which these analyses are based must correctly represent threat force system capabilities, threat force combat, threat combat support, and threat combat service support. Although treatment of the threat is not specifically addressed in the model architecture, threat is generally addressed through equal representation in the model input data, decision rules, and scenario specifications (i.e., force structure and composition, weapons/munitions). Those conducting analyses must know the strength, weaknesses, and limitations of any model selected with respect to representation of the threat. Threat data provided by supporting intelligence organizations must be accurate, current, and derived from validated intelligence products and data bases. IAW AR 381-11, deviations from validated scenarios or threat data, must be documented and forwarded through the Operational Test and Evaluation Command (OPTEC), and the Deputy Chief of Staff for Operations and Plans (DCSOPS) to the Department of the Army Deputy Chief of Staff for Intelligence (DA DCSINT) for approval. Results of the analyses must indicate any deviations and associated implications.

c. The TEMP is the principle document for test scheduling and planning for the T&E community and program manager. The TEMP should document required analyses and testing. COEA analyses, DT results and OT results should be synthesized and analyzed to provide a comprehensive evaluation.

d. Current acquisition policy (DOD 5000 series) states that the COEA and test and evaluation are aids to decision-making. The COEA aids decisionmakers in judging whether any of the proposed alternatives offers a cost effective approach to meeting the operational requirement. Test and evaluation aids decisionmakers by verifying that systems have attained their technical performance specifications and objectives and that they are operationally effective and operationally suitable for their intended use.

e. Current acquisition policies (DOD 5000 series) also state

that a linkage should exist between COEAs and test and evaluation. Specifically, DODI 5000.2, Part 4, Section E, paragraph 3.a(5) Measures of Effectiveness states:

> "To judge whether an alternative is worthwhile, one must first determine what it takes to make a difference. Measures of effectiveness should be defined to measure operational capabilities in terms of engagement or battle outcomes. Measures of performance, such as weight and speed, should relate to the measures of effectiveness such that the effect of a change in the measure of performance can be related to a change in the measure of effectiveness.

(a) Comparable measures for each alternative are evaluated against a baseline, generally the outcome that would exist with currently programmed capabilities.

(b) The complexity, scope, and output measures of mathematical models selected for the analysis should be appropriate to the system being evaluated. For example, a battalion size model need not be run to evaluate a new truck, and an antisubmarine warfare campaign model is not necessary for assessing the performance of new carrier onboard delivery systems.

(c) Measures of effectiveness should be developed to a level of specificity such that a system's effectiveness during developmental and operational testing can be assessed with the same effectiveness criteria as used in the cost and operational effectiveness analysis. This will permit further refinement of the analysis to reassess cost effectiveness compared to alternatives in the event that performance, as determined during testing, indicates a significant drop in effectiveness (i.e., to or below a threshold) compared to the levels assumed in the initial analysis."

DODM 5000.2-M, Part 8, paragraph 2.a(5) states:

> "A comprehensive test and evaluation program is an integral factor in analyzing operational effectiveness, since it will provide test results at each milestone decision point that give credence to the key assumptions and estimates that may have been made in the current or earlier cost and operational effectiveness analyses".

16-7. Credibility of Models and Simulations

a. As the use of models and simulations has increased, the models and simulations themselves have grown in size and complexity. In fact, many simulations that support the acquisition process are too complicated to be sufficiently understandable by decision-makers, testers, and analysts in a cursory review. This has led to concerns related to their application. It is important to ensure that the results of simulations used to support major test and evaluation are credible. Steps must be taken to assure a high level of confidence in the results provided by such models and simulations and that the proper model has been used to address the acquisition decision issues.

b. An essential attribute of any useful M/S is that it has earned a high degree of credibility; i.e., its construction, execution, and the interpretation of its output results are considered to be "good and true", when taken in the proper context by a community of peers.

c. System and subsystem models at the engineering level, particularly those which model functions that do not represent combat environments, seem to enjoy a fairly high level of credibility among analysts and decision makers, e.g., it is virtually impossible to imagine a modern aircraft development program that would not make extensive use of wind tunnels and flight dynamics simulations. It has been shown that these simulations frequently permit a reduction in the number of aircraft flight hours required during the development process. This high level of simulation credibility can be attributed to the degree of development of aerodynamic sciences (at least empirically) and the use of instrumented aircraft flight test data collected to continually improve the fidelity of such simulations.

d. Complex combat M/S which estimate operational performance naturally encounter more skepticism among decision makers due to the M/S simplifying assumptions and the fact that the fundamental theoretical mathematical bases for aggregation and disaggregation are less well understood. The difficulty in representing the impact of human performance factors in combat (stress, fatigue, shock, etc.) adds to the skepticism. It could be argued that only actual combat, with instrumentation to collect data, could fully resolve all the suspect elements of simulation. The use of multiple models with different theoretical approaches and assumptions may provide a hedge against the uncertainty of our fundamental knowledge of combat processes and of our ability to implement these processes into a model. These different approaches and assumptions must be made clear, however, or the

different models are likely to generate more confusion than insight.

e. In order to promote credibility of M/S, HQDA issued a policy memorandum in October 1989 which mandated the validation, verification and accreditation (VV&A) of models and simulations used as acquisition decision making tools in the Army acquisition process. In June 1990, an additional Army policy was issued which extended the VV&A mandate to include research, development and engineering (RD&E) models and simulations. Both Army policies have been incorporated into AR 5-11, Army Model and Simulation Management Program dated 10 June 1992. Samples of credibility issues that need to be addressed when applying models and simulations to test and evaluation are contained in Table 16-2. Prior to using any M/S (where the results will be used in the Army acquisition decision making process), it must undergo a formal VV&A. Information on models which have been formally accredited can be obtained from the Army Model Improvement and Study Management Agency.

(INSERT TABLE 16-2)

Section III
Examples of Using M/S in Developmental Test and Evaluation (DT&E)

16-8. General

a. Developmental testing is a generic term which encompasses engineering-type testing, and software development testing. It addresses the systems technical characteristics and contributes to the acquisition and fielding of an effective, supportable, and safe system. Generally, it requires instrumentation and measurements, and is accomplished by engineers, technicians or soldier operator-maintainor test personnel. The categories of developmental test are defined in Chapter 4, AR 73-1. M/S opportunities to supplement these tests are numerous. The following examples, while not exhaustive, represent instances where M/S have been used effectively in developmental T&E. In addition, examples of the application of M/S in T&E are listed in Table 16-3.

(INSERT TABLE 16-3)

16-9. PATRIOT Air Defense System

a. Extensive use of modeling and simulation has been made

during the development, testing, fielding, and upgrading of the PATRIOT Air Defense System. PATRIOT simulations include:

(1) The Flight Mission Simulator (FMS). The FMS is a device which loads the PATRIOT radar by supplying inputs representing the electronic countermeasure (ECM) environment, natural clutter, multiple maneuvering targets, and missiles in flight. The PATRIOT fire unit can conduct normal surveillance and engagements concurrently with FMS loading. To exercise the PATRIOT system to its full specified capability, simulated missile firings are conducted against simulated targets with target loading provided by a combination of actual aircraft and aircraft simulated by the FMS.

(2) The Guidance Test Support Facility (GTSF). The GTSF is a hardware-in-the-loop simulation of the PATRIOT guidance system. It provides a detailed simulation of the guidance system and missile response for one missile flyout. This simulation is used for missile preflight test performance prediction, post-flight analysis, system performance evaluation, and ECM analysis.

(3) H-1. The H-1 is a detailed hybrid simulation of the PATRIOT guidance system from prelaunch through intercept. This simulation is used for preflight and postflight analysis. The guidance and control characteristics that exist as actual hardware in the GTSF are simulated in H-1.

(4) S-1. The S-1 is a Monte Carlo digital simulation of the PATRIOT radar and Engagement Control Station (ECS) resident software. The outputs of S-1 include radar surveillance and kinematic intercept ranges which provide a basis for estimating the probability of detection, evaluation, and transfer.

(5) Lethality Endgame Simulation (LEGS). LEGS is a digital endgame simulation that uses Monte Carlo techniques to calculate probability of kill. LEGS includes an endgame kinematics model, a fuze model, a warhead model, and a lethality prediction model. Intercept geometries are defined by flight test data or H-1 simulation results. LEGS is used to evaluate the probability of kill against threat targets based upon flight test intercept geometry.

b. Use of these simulations has allowed more complete evaluations of the PATRIOT system with fewer required flight tests. Some specific examples follow:

(1) Prototype Qualification Test - Government (PQT-G)/Engineering and Manufacturing Development (EMD). Use of the

Flight Mission Simulator permitted the specified target loading and multiple simultaneous engagement capability to be tested. It allowed a large number of targets/engagements to be simulated while the radar was emitting and processing returns from terrain, chaff, and live Standoff Jammer (SOJ), Escort Jammer (ESJ), and Self Screening Jammer (SSF). Without the FMS, the full target/engagement load could not have been tested. Also, the multiple simultaneous engagement capability could be repetitively tested. An actual test would have required multiple intercepts within a very short period of time, conditions that are very expensive to test with low probability of success. The GTSF was used during development to help design and improve the system, and to predict performance. The GTSF allowed testing missile guidance logic for a wide variety of ECM waveforms. Use of the GTSF allowed repetition of ECM conditions that would not have been permitted on the test range. Although limitations on the number of signal channels did require certain flight tests of selected formations of SSJ with responsive waveforms in chaff/ground clutter, missile flights were used essentially to confirm GTSF results. Use of the GTSF substantially reduced the number of flight tests and minimized using actual missiles to find ECM limitations of the system.

(2) First Article Test. Due to the use of the GTSF, four missile firings were adequate for the technical evaluation of this phase, and an additional four firings for operational testing. The FMS was used to verify both system maximum loading capability and multiple simultaneous engagement performance. In addition, a special version of the tactical software was developed which simulated missile engagements (did not simulate radar and computer engagement loading as did the FMS). This allowed for a more realistic follow-on evaluation and for technical and operational tests to be conducted in an environment containing chaff, SOF's, SSJ's, and numerous simulated aircraft. More recently, simulated tactical ballistic missiles (TBM's) have been included in the test scenarios.

16-10. STINGRAY Countermine System

a. Another example of the use of models and simulation to augment developmental test and evaluation involves the use of the Low Energy Laser Weapon Simulation (LELAWS) in the T&E of the STINGRAY system. STINGRAY is intended to act as a countermeasure to optical and electro-optical targeting systems. LELAWS is a simulation which estimates the probability that a given countermeasure was successful. In preparation for the STINGRAY Concept Demonstrator (CD) developmental test, LELAWS was used to estimate downrange laser energy. This information was used to

determine STINGRAY CD test instrumentation/calibration requirements. As LELAWS was to be used in STINGRAY's upcoming COEA, the PM-STINGRAY authorized a number of test runs dedicated solely to supporting the validation of the LELAWS methodology. After the STINGRAY CD testing was completed and the test data applied to LELAWS validation, LELAWS was used to conduct a risk assessment on the STINGRAY's ability to meet user performance requirements in its next phase of development. The risk assessment was conducted by inputting near-term STINGRAY technology options into the LELAWS model, estimating STINGRAY performance using the validated LELAWS methodology, and comparing LELAWS output to STINGRAY user requirements.

16-11. Mine Systems

a. MINEMIX has and is being used to supplement test and evaluation efforts related to the development and fielding of the Army's mine/barrier systems. The MINEMIX model is a Monte Carlo simulation structured to provide estimates of minefield effectiveness for various 'mixes' of both anti-personnel and anti-materiel mines. Conventional, scatterable, and SMART mines can be included in the layout of various minefields. The performance of individual mines is described by a collection of parameters that indicate: arming reliability, fuzing reliability, target vulnerability, probability of being a 'dud', countermeasure probability, etc. The model provides the capability of estimating the effectiveness of 'minefields' against target arrays which are constructed of different types and numbers of vehicles, e.g., main battle tanks, APCs, squad formations of personnel, and wheeled vehicles. The matrix of output produced by the model enables the user to depict the exact configuration of the minefield, along with a tally of the "killer/victims", i.e., which mines defeated which targets.

b. In the context of T&E, MINEMIX has been used to supplement limited testing of the expensive Wide Area Mine (WAM). The effectiveness of the WAM is a function of the distance at which the mine detects and attempts to engage a valid target that enters its zone of authority. In order to address questions of minefield effectiveness, MINEMIX supplements the test data acquired at specific 'ranges' and allows the analyst to examine issues such as the requirement for range sensitivity, mine spacing, mine mixing with scatterable mines, etc., without additional test results. The output of the MINEMIX simulation was used to assist in the formulation of valid requirement parameters that became part of the approved requirements document for the Wide Area Mine.

c. In terms of reducing testing, MINEMIX, coupled with other 'engineering' simulations can be used to fill voids left by the limited testing that is planned for the Wide Area Mine. For example, the effectiveness of WAM is also a function of the point on the target which is hit by the explosively formed penetrator. Captive flight tests of the sensor are used to build a database of 'hit points' for various launch conditions which then serve as an input array to the MINEMIX model to allow sensitivity studies concerning this key parameter. In addition to captive flight tests, various engineering simulations of the sensor/target encounter are also used to provide input to the MINEMIX model and to supplement 'live mine' testing against actual or surrogate targets.

16-12. C3I Systems

a. The Simulation/Stimulation (SIM/STIM) software is a real-time, multitasking system which provides two functions related to test and evaluation for the Army Field Artillery Tactical Data System (AFATDS) testbed. First, it simulates those nodes (units) in the Brigade slice which are not present within the given AFATDS system under test (SUT). This is accomplished by first simulating messages which occur between simulated nodes and performing the actions of the simulated nodes with realistic timing. Second, SIM/STIM simulates the real equipment within the SUT by transmitting representative messages from the simulated nodes, as well as receiving and processing message traffic from the SUT.

b. SIM/STIM was first developed for use in AFATDS concept evaluation testing. Currently, SIM/STIM and its derivatives are being planned as an integral part of the Fire Support Automated Test System (FSATS) which is a suite of test instrumentation to be used to support test planning, test design, test execution, data reduction, data analysis, and test reporting associated with the technical and operational tests of the Army's fire support systems. Initially, FSATS is envisioned for use in the Post Production Test and Evaluation and in the Initial Operational Test and Evaluation of the AFATDS system.

16-13. Live Fire

a. A Live Fire Test is a type of developmental test, the objective of which is to support a timely and thorough assessment of the vulnerability/lethality of a system as it progresses through its development and subsequent production phases. Live Fire Test and Evaluation (LFT&E) should demonstrate the ability of the weapon system or munition to provide for system

survivability or munition lethality. The objective of LFT&E is to provide insights into the principal damage mechanisms and failure modes occurring as a result of the munition/target interaction leading to improved techniques for reducing personnel casualties or for enhancing system survivability or munition lethality. Data from LFT&E should help identify specific failure and damage mechanisms. With this knowledge, cost effectiveness trade-offs can be conducted to predict the optimal "mix" of system vulnerability reduction/munition lethality enhancement measures.

b. Live Fire Testing, even when supplemented with other developmental testing, cannot produce sufficient data to assess the vulnerability or lethality of a system for all combinations of threat, impact, and engagement conditions of interest. Thus, modeling must be used to extend test results to account for the conditions which are of interest but are impractical or impossible to test. In the context of LFT&E system, vulnerability/munition lethality modeling has four basic roles: support test design, support the evaluation of system and crew vulnerability or munition lethality, guide and evaluate vulnerability reduction or lethality enhancement efforts, and methodology diagnosis.

c. Detail on the classes and roles of system vulnerability/ munition lethality modeling in LFT&E are contained in Part VI.

Section IV
Areas for Using M/S in Operational Test and Evaluation (OT&E)

16-14. General

a. It is impossible to address all the possible or even likely uses of M/S within the OT&E process. Categories of OT are listed in Chapter 5, AR 73-1. Test requirements span a wide spectrum of conditions and are seldom standardized. There are, however, four areas in which the analytical community and M/S can significantly aid the operational tester: (1) Development (crew training analyses/evaluations and tactics and operational techniques development); (2) Test planning and operational scenario development; (3) Data extrapolation/interpolation beyond test results; and (4) Test execution. These applications of M/S can supplement testing and provide a much more robust and informative evaluation. The following concepts and examples are intended to characterize basic principles and processes.

16-15. Crew Training Analyses/Evaluations

a. Operational testers have become involved in training and training development through Force Development Test and Evaluations (FDT&E). The implementation of the FDT&E process stemmed from an identified need for more comprehensive training of units prior to operational testing. Insights gained from several operational tests (M1 tank, AH-64A and OH-58D helicopters) indicate that modern weapon systems require comprehensive tactics and operational techniques development to fully exploit weapon system improvements. For these tests, field training was required to fully develop operator skills. It is envisioned that training demands on resources and test facilities will continue as next generation aircraft, armored systems and command and control systems are tested. Multifunction systems will task the limits of operators during operational testing.

b. In addition to using models to aid training, they are inherent in the Training-Modeling Integration (T-MI) methodology which uses test data and modeling to evaluate crew and individual performance during conduct of the test. Crew evaluation requirements are not isolated to only FDT&E. All types of operational testing require crew performance evaluation. The T-MI methodology was developed within the U.S. Army Training and Doctrine Command (TRADOC) for the investigation and development of crew and individual training information. M/S is used to develop training scenarios, performance standards, and task workload information. T-MI has application in addressing weapon system crew training requirements as well as real time crew performance evaluations during operational testing.

c. Training and crew performance analyses need detailed data which identify when a specific event occurred (time tagged data). High resolution simulations producing detailed time related history files provide an excellent source for these type of analyses. CASTFOREM (battalion/task force level model) is one of the current models used by TRADOC that produces comprehensive time related history file information. More aggregated low resolution simulations are less useful for training analysis.

16-16. Tactics and Techniques Development
Use of M/S to aid in the development or refinement of tactics and operational techniques differs from their use in individual training because the two analytical processes often require different simulation tools. The interactive, man in the loop, high resolution simulation is a tool used for the development of tactics and operational techniques. JANUS, for example, has been used widely for this application. The tester can benefit

significantly from insights gained in the use of M/S to examine tactics and operational techniques. Test design scenarios can be reviewed in advance in order to better understand weapon system tactics and techniques. It benefits the entire testing process if effective and well defined tactics are developed prior to beginning the test.

16-17. Test Planning and Operational Scenario Development

a. Information available from M/S may be used to design specific test events that are in fact sensitive to critical system operational issues. M/S results may aid decisions regarding sampling, ordering of test events, and scaling. Scenario development is a broad subject which impacts test issues and operational concerns; terrain analysis, tactics, doctrine, pace of battle, etc. Recent applications of M/S used in scenario development have concentrated on developing insights into test exercise sensitivity to terrain, to the number of threat and friendly players, to position/location of stationary weapon systems, and to the general pace of battle.

b. JANUS and CASTFOREM have been used to develop scenario information for operational tests of the following systems; Pedestal Mounted Stinger (PMS), Line-of-Site Forward (Heavy), and M1A2 tank. In most of the scenario development processes JANUS provided the most utility. The ease with which the modeler and tester can incorporate the insights of proponent and crew/ operator into the JANUS simulation facilitates scenario development.

16-18. Data Extrapolation/Interpolation

a. Modeling may be a cost effective supplement to operational testing when test limitations and constraints are significant. In order to use M/S data for evaluation of a system under conditions differing from the actual test, it is essential that M/S results and test results be compared to determine the appropriate calibration effort. Calibration is a careful and intuitive model/simulation modification process in order to correlate model output and test results. Calibration should be undertaken with caution. Changing model parameters to achieve high correlations is only prudent if the changed parameters are logical and address intuitively correct deviations from established algorithms. The model accreditation process will address calibration. The process will require identification of model parameter changes and the rationale, for such changes.

b. Tester and evaluator, using an accredited model, have an

opportunity to augment or supplement field test results with modeled results. Extrapolation can take the form of selecting different terrain or employing larger forces. Interpolation can take the form of expanding sample sizes for trials that were difficult or expensive to perform.

16-19. Test Execution

a. M/S applications in support of test execution include both those of control and actual conduct. As systems become more complicated and include more computer hardware and software (embedded or otherwise), the challenge of executing a user test increases. Automated stimulation can eliminate large scripting and controller cells, which simplifies the control task. Also, some simulations can help the control function by portraying the overall status of a scenario and isolating problem areas, which would not be manageable by manual means, so that test officers can take immediate corrective actions when necessary.

b. In the conduct of a test, stimulators, emulators, drivers, and simulators (SEDS) are often the only economically or practically feasible means to conduct a large scale test. Examples of SEDS are:

Simulator: Close Combat Tactical Trainer (CCTT)

Emulator: Real Time Casualty Assessment (RTCA)

Driver: Corp Battle Simulation

Stimulator: Tactical Simulator

c. For example, simulators may provide intelligence sensor data from echelons above corps (EAC) during an intelligence system test. Since personnel participating in test must often be trained on how to operate complex equipment before that equipment is available, this can generate a need to develop simulator training devices (integrated or standalone) at the same time as the system. Often such training devices can serve multiple functions such as simulators, stimulators, and data collection simultaneously. The tester must coordinate with the combat developer early in the process and describe his requirements. The same need to capture data for a test may also be one required of the trainer (e.g., capturing operator actions). As modeling becomes more standardized, extensive sharing of model architecture and algorithms could aid both the combat developer and the tester. Other uses of M/S are test unique and critical for testing. For example, M/S is often used to provide Real Time

Casualty Assessments (RTCA) during the conduct of force-on-force testing. RTCA may vary in operation from simple look-up tables to sophisticated weapon fly-out models. Other real-time applications for OT&E (SEDS) include scenario drivers which generate events and reports to information management systems or command elements, simulators which inject messages in communications channels, simulators of sensors or response command and control cells, flyout or endgame models, and loading devices for software processors or communications networks. No matter how M/S is utilized in test, execution has the same requirement to be accredited for each application as M/S for any other use.

16-20. Model-Test-Model (MTM) Process

a. As introduced in paragraph 16-6, current acquisition policy promotes more effective linkage of analyses and testing. COEA and OT&E linkage is the objective of recent MTM initiatives. The MTM concept consists of a calibration scheme or use of observations to adjust model parameters or algorithms. The MTM process is accomplished through the following steps: model the scenario; observe test play; constrain the model to test conditions; compare model measures to observations; adjust the model; re-model the scenario, and repeat as necessary. The general process is not new. References to the basic components: pretest modeling, modeling and test comparison, and post test modeling, can be documented in Army testing as far back as the early 1970's.

b. The first component of MTM is pretest modeling. Pretest modeling estimates a range of test results prior to conduct of record trials/events. These results may aid the tester in supporting test design and test scenario development. Normally the MTM pretest phase addresses the adequacy of test profiles/scenarios to support the test objectives; e.g., are expected ranges of engagement or ranges for communications expected to be sampled? Additionally, pretest M/S can be used to make more efficient use of test resources to avoid impractical use of test assets. If M/S shows that certain levels of countermeasures are expected to render the test item ineffective, sufficient testing to define the envelope of these levels must be conducted to validate the M/S predictions; however, little testing beyond this needs to be planned for those conditions. If some tactically deployed targets are shown by modeling to have no reasonable chance of being in the line-of-sight (LOS) to systems requiring LOS, those assets can either be saved or used elsewhere. Modeling or simulation can also be used to scale resources such as targets, warheads, or countermeasures in order

to obtain equivalent MOE given constraints of resources, ranges and test units. Modeling or simulation can be used to train test personnel, support test design (number of trials, size of Blue and Red forces, check execution timing, plan location of test support equipment, validate threat surrogates/simulators), estimate key factors/conditions which most impact system performance, and develop and refine test design matrices.

c. The second component of MTM is comparison of modeling and test results. This phase begins with conduct of the operational test. Extensive work is required to develop adequate operational realizations of systems in combat models. The model results and test results must be compared to determine the significance of differences that may occur. The comparison must assess if calibration of the model is appropriate. Calibration should be conducted when it is determined that model components must be adjusted before any further application of the model will be accredited. Examples of model components critical to accreditation for T&E purposes include: weapon system algorithms, man-machine and environmental interfaces, and the model scenario representation.

d. The third component of MTM is post test modeling. This final phase of the process is the use of the model to make additional estimates. These estimates may supplement test results. Issues for evaluation and the completeness of the test will determine exactly what modeling will be required. Listed below are examples of how models and simulations may be used to augment and extend test results as well as explain unexpected test results:

(1) Applying Measures of Effectiveness (MOEs)/Measures of Performance (MOPs) to situations other than those tested (running many iterations based on trial results, varying terrain, varying force sizes).

(2) Investigating potential benefits of product improvement or changes in doctrine or organization.

(3) Analyzing the sensitivity of the evaluation findings to known limitations in approximating realistic mission profiles, for example, types of countermeasures which could not be played.

16-21. Other Simulation Sources

a. A supplemental source of simulation support for OT&E is the Army Distributed Interactive Simulation (DIS) efforts. The current on-line portion of the DIS is SIMulator NETworks

(SIMNET), the first simulation system to integrate large numbers of manned vehicle simulators on a computer network.

b. Battlefield Distributed Simulation-Developmental (BDS-D), the follow-on system for development applications, provides a simulation capability that allows experimentation with human system interaction in a fully represented battlefield environment.

c. The follow-on system for training is the Combined Arms Tactical Trainer (CATT). The first system to be acquired under the CATT program is the Close Combat Tactical Trainer (CCTT). The CCTT will incorporate a man-in- the-loop high resolution combat training simulator, useful in simulating multi-system interactions in a nonlinear battlefield environment.

d. Both BDS-D and CATT have potential for developing and/or testing new doctrine and tactics associated with developmental systems. They can also be used to measure the contribution to system effectiveness of the human interaction with the developmental system.

Table 16-1. Points of Contact Relative to Test and Evaluation Model and Simulation Support

a. Theater and above Level Force on Force Models - focuses on all force levels at echelons above corps. Includes multi-corps, regional and global models and simulations (e.g., Force Evaluation Model (FORCEM), Concepts Evaluation Model V (CEM VI), Force Analysis Simulation of Theater Administrative and Logistic Support (FASTALS), Transportation Model (TRANSMO)

POC: U.S. Army Concepts Analysis Agency
Research and Analysis Support Directorate
ATTN: CSCA-RS
(301) 295-1692
DSN: 295-1692.

b. Corps and Division Level Force on Force Models - focuses on single and multi-division levels of operation with or without a supervising corps headquarters (e.g., EAGLE, Corps Battle Analyzer (CORBAN), Vector in Commander (VIC), JIFFY, Command, Control, Communications, and Combat Effectiveness (FOURCE).

POC: U.S. Army TRADOC Analysis Command
Corps/Division Modeling and Analysis Operations
Analysis Directorate Support Center
ATTN: ATRC-OAC, Fort Leavenworth, KS
(913) 684-2276
DSN: 552-2276.

c. Brigade Task Force Level and Below Force on Force Models - focuses on combined arms forces and single functional elements as they are represented as integral parts of combined arms and services activities (e.g., Combined Arms and Support Task Force Evaluation (CASTFOREM); JANUS(T), ELANT, American Australian British Urban Game (ACABUG).

POC: U.S. Army TRADOC Analysis Command
Brigade/Battalion Modeling and Analysis Support Center
ATTN: ATRC-W, White Sands Missile Range, NM
(505) 678-1012
DSN: 258-1012.

d. Item System Level Performance Models - focuses on a single weapons system or piece of equipment. May address one on one or one on many situations (e.g., Air Defense Air-to-Ground Engagement (ADAGE), Artillery Force Simulation Model (AFSM), Simplified Artillery, Reliability Growth Model, SESAME, Projectile Effectiveness Model (ARTQUIK), TANKWARS, NATO Reference Mobility Model).

POC: U.S. Army Materiel Systems Analysis Activity
Special Studies and Activities Office
ATTN: AMXSY-DA

(410) 278-6576
DSN: 298-6576.

e. Item System Level Weapon Systems Performance data for U.S. and threat systems and characteristics data for U.S. systems - data focuses on the lowest level system such as an air defense gun with its crew or a tank with its crew (includes reliability and supportability).

POC: U.S. Army Materiel Systems Analysis Activity
Special Studies and Activities Office
ATTN: AMXSY-DA
(410) 278-6576
DSN: 298-6576.

f. Item System Level Weapon Systems, operational and characteristic data for threat systems - focuses on the characteristics of lowest level threat system such as an air defense gun or tank.

POC: Office, Deputy Chief of Staff for Intelligence
HQDA (ODCSINT)
ATTN: DAMI-FIT
(703) 614-8121
DSN: 224-8121.

g. Engineering/Hardware in the Loop Models - focuses on models and simulations which augment testing in various stages of the materiel acquisition process. Models and simulations are used in investigating mechanical, electrical, and physical phenomena associated with the functioning of an item system in an engineering sense (e.g., Dynamic Ground Target Simulator (DGTS), Dynamic Analysis and Design System (DADS), Wide Area Mine Sublet Simulation, Tow Weapon System, LOSA-T All Digital Six Degree-of-Freedom (6-DOF) Simulation Development and Test Simulation (DTSIM).

POC(s): U.S. Army Research, Development and Engineering (RD&E) Centers, U.S. Army Communications - Electronics Command
ATTN: AMSEL-RD-AED-MA
(908) 544-4682
DSN: 992-4682.

U.S. Army Tank-Automotive Command
ATTN: AMSTA-RYA
(313) 574-8633
DSN: 786-8683.

U.S. Army Armament, Munitions and Chemical Command
ATTN: AMSMC-SA
(201) 724-5262
DSN: 880-5262.

U.S. Army Missile Command
ATTN: AMSMI-RD-SS
(205) 876-4271
DSN: 746-4271.

U.S. Army Aviation and Troop Command
ATTN: AMSAT-B
(314) 263-1171
DSN: 693-1171

POC(s): U.S. Army Research Laboratory
(301) 394-4650
DSN: 290-4650.

For PEO/PM managed systems it is common practice for the PEO or PM to sponsor contractor M/S development related to the T&E of their individual systems. For systems of interest contact the respective PEO/PM to determine the availability of M/S tools and their state of accreditation.

h. Vulnerability.

U.S. Army Ballistic Research Laboratory
ATTN: SLCBR-VL
(410) 278-1171
DSN: 298-1171

i. Technical Testing.

POC: U.S. Army Test and Evaluation Command
Technical Director
ATTN: AMSTE-TD
(410) 278-4370
DSN: 298-4370.

j. Operational Test and Evaluation.

U.S. Army Operational Test and Evaluation Command
ATTN: CSTE-MP
(703) 756-1818
DSN: 289-1818

U.S. Army Test and Experimentation Command
ATTN: CSTE-TDS-IR
(817) 288-1221
DSN: 738-1221.

k. Model-Test-Model.

U.S. Army TRADOC Analysis Command - WSMR
ATTN: ATRC-WMC
(505) 678-6016
DSN: 258-6016

U.S. Army Operational Test and Evaluation Command
ATTN: CSTE-MP
(703) 756-1818
DSN: 289-1818

l. Verification, Validation, and Accreditation of Models and Simulations - focusses on verification (determined that the model and simulation accurately represent the developer's conceptual description and specifications), validation (determination of extent to which the model and simulation accurately represent the real-world from the perspective of the intended use) and accreditation (determination that the model and simulation is acceptable for its intended purpose) of those models and simulations recognized as requiring management within DA and in accordance with AR 5-11, Army Model and Simulation Management Program (AMSMP) (e.g., all models and simulations identified by proponents as requiring V,V&A under management of the AMSMP).

POC: HQ DA
U.S. Army Model Improvement and Study Management Agency
ATTN: SFUS-MIS
(703) 746-8072
DSN: 286-8072.

m. Man-in-the-loop Training Simulators.

POC: U.S. Army Simulation, Training, and Instrumentation Command
ATTN: AMSTI-TD
(407) 380-4325
DSN: 960-4325.

Table 16-2. Credibility Issues to Address
in Using Models and Simulations to Support T&E

Credibility, as applied to modeling and simulation processes and results, is a combined impression of the inputs, processes, outputs, conclusions, persons or agencies involved, and the strength of the evidence presented. This appendix contains questions that the developing, review, and user communities should ask and/or be prepared to answer when models and simulations are used to support Test and Evaluation.

1. Issues relating to Verification, Validation, and Accreditation (VVA) of Models and Simulations (M/S).

a. Has the M/S gone through an approved process to establish its credibility for this specific application?

b. Were M/S results compared with combat, field test, and other models? If so, what were the results?

c. What have the results been validated against?

d. What is the availability, date, and source of data? Is data available to support system requirements? If not, what assumptions will be made? How will critical variables be represented? Is there imbedded data in the model? If so, are those variables documented and is the data defined? Who has reviewed and certified the use of this data for the study?

e. How robust are the results on operational capability and supportability?

f. Who built the model?

g. Who certified model inputs?

h. Who certified the tactics/scenarios or changes to existing scenarios?

i. Who did the verification and validation?

j. What implicit and explicit assumptions were made? What are the model limitations?

k. Is there sufficient documentation of the model, its assumptions, data requirements and methodology?

l. What sensitivity analyses have been performed?

m. How far has the model been pushed to extremes and how has it performed? Has the M/S domain been established?

n. What field test results have been fed back into the model for validation?

o. Is there a documented audit trail of data, methodology and code changes, and scenario changes? Will it provide traceability of critical decisions?

p. Who maintains the model?

q. What is the source of threat data? Is it consistent with data used in other analyses? What is the source of threat (RED) tactics used in the scenario?

r. What variables of the operational environment are not represented?

2. Issues relating to the study concept.

a. Why was this model used in lieu of testing? What specific questions are to be addressed by the model?

b. Was M/S discussed in the TEMP?

c. Did the simulation accurately reflect the system requirement and any available developmental test data?

d. What is the linkage between TT&E and OT&E and modeling?

e. Why was this particular model chosen? What was it designed to do? What are its strengths/weaknesses? Where has it been used before?

f. Is there adequate funding to support the M/S? By whom? Is the M/S cost-effective?

g. What elements of M/S should be confirmed by operational testing?

h. Were excursions conducted on critical variables and system parameters? If so, why and what were they?

i. What impact (if any) did the excursions have on the evaluation?

j. What is the degree of independence of modelers with respect to the program office, material developer and hardware contractor? If the M/S developer is associated with the program office, who conducted the independent assessment of the M/S applicability?

k. Has this model been used by the developer of the weapon system? What were the results?

l. Who is expected to use or operate the model?

m. Can the model be designed, built and/or modified faster and/or cheaper than the system it represents?

n. If multiple models are used, what are the linkages? What are the data structures?

Table 16-3. Examples of the Application of Modeling and Simulation in Test & Evaluation

1. To support pretest planning.

2. To assist in the identification of critical issues to be addressed in a test.

3. To identify important test parameters earlier.

4. To grossly bound the problem and proposed solutions based on the intended environment, force structure, threat, tactics, strategy, and doctrine.

5. To identify oversights and flawed logic.

6. To determine sensitivity of a program to various input parameters.

7. To conduct non-destructive evaluations of high cost items which would, by their nature, be destroyed in actual hardware tests.

8. To provide better understanding when full-scale testing is not possible. To augment, extend, and enhance test results, in general.

9. To provide multiple "environments" for examining test questions.

10. To provide advantages of test compression, control expenditures, provide for replicability, and reduction of variables under study.

11. To assess impact of known parameters of unavailable threat systems.

12. To accomplish human factors supportability evaluations in part-task or limited fidelity "mock-ups".

13. To provide estimates of potential test outcomes.

14. To extrapolate, with caution, test results into other scenarios and levels of force aggregation.

15. To address issues which cannot be physically tested.

16. To address "what if" questions during post-test analyses.

17. To develop and refine test scenarios and data matrices to obtain maximum data from limited test resources.

18. To develop new tactics for the employment of new weapon systems under test.

19. To provide overall system, scenario, or environment representation.

20. To represent the input, process, and output of non-available systems, subsystems, or components (friendly, or threat).

21. To represent the whole integrated system when all components are not available.

22. To allow an assessment of test events that would otherwise be exposed to threat intelligence exploitation.

23. To act as a system driver or stimulator in order to stress a system beyond available field test scenarios.

24. To determine adequacy, effectiveness, and suitability of the planned operational, maintenance, and supportability concepts.

25. To estimate mature system mission reliability, availability, and logistics support frequency.

Chapter 17
Test Incidents and Related Reporting

17-1. General

a. This chapter will discuss policies, procedures, and responsibilities for the reporting of test results, corrective actions, and closures to enable the continuous evaluation process to function. The ultimate purpose is to ensure that test results are made available on an expedited basis for evaluators, program executive officers, and decision makers to analyze emerging data and assess system performance. The term "tester" used in this chapter refers to the on-site organization actually conducting or monitoring the test and collecting and reporting the data.

b. The Test Incident Report (TIR) is the means by which the minimum essential data for test incidents, their respective corrective actions, closures, and other test information are reported. The TIR form (DA Form XXXX-R) is shown in Figure 17-1. The TIR contains two types of data. One type consists of test incident (TI) data. The tester prepares this data. The tester omits section VI when preparing the TIR. The other consists of corrective action (CA) and closure data which are prepared by the program manager. These two data types are merged together by the Army Test Incident Reporting System (ATIRS) at Aberdeen Proving Ground, MD, which is administered by the U.S. Army Combat Systems Test Activity of the U.S. Army Test and Evaluation Command.

(INSERT FIGURE 17-1)

17-2. Requirements

a. Materiel developers, combat developers, evaluators, and other organizations participating in the acquisition process must be informed of system performance during tests in a timely manner so that test information is available for immediate use by acquisition community members, corrective actions initiated, and the continuous evaluation of the systems enhanced.

b. The TIR is used as the medium to provide the results of any incident occurring during test and to report corrective actions taken. Also, the TIR reports the results of subtests and serves as an interim report, when a formal test report has not been published. TIRs will be completed using the instructions provided in Figures 17-2 and 17-3.

(INSERT FIGURE 17-2)

(INSERT FIGURE 17-3)

c. Incident reports, maintenance data, and corrective action information are also required by Reliability, Availability, and Maintainability (RAM) scoring and assessment conference members to form the basis for the assessment of RAM per AR 702-3 and integrated logistics support (ILS) per AR 700-127.

d. The test incident and corrective action data in the TIR will be added into ATIRS. ATIRS provides an Army standard method of electronically exchanging, storing, processing, and reporting data on results of testing, their corrective actions, and other test-related information. ATIRS is used for the storage of all test incidents, corrective actions, and closure information. Assistance on ATIRS is available by electronic mail through the Defense Data Network (DDN) at atirs@csta-emh1.apg.army.mil or by submitting a request to Commander, U.S. Army Combat Systems Test Activity, ATTN: STECS-DA-CA, Aberdeen Proving Ground, MD 21005-5059.

e. The tester prepares TIRs for all government, required contractor tests and for Production Phase tests which support a materiel release decision. TIRs may also be prepared for other tests as required by the program manager or other test sponsors.

f. The program manager prepares corrective action and closure data reports for input into ATIRs for critical, major, and major-linked repetitive minor TIRs as a minimum. All TIRs must be considered for corrective action, and the TIR should reflect action taken with supporting rationale. After consideration the decision may be that no corrective action is required for minor TIRs, the intent is to produce a better system.

g. Production and post production tests of ammunition are excluded from submission of TIRS. The reporting procedures in AR 75-1 are used for these items.

17-3. Security

a. Since the TIR data will be transmitted, stored, and interactively accessed via unsecured media, care must be taken to ensure that documents provided to ATIRS contain no classified information.

b. In the event that information pertaining to a test incident is classified, the information will be published separately in a classified TIR and distributed per the listing agreed to by TIWG members. Additionally, an unclassified report

will be provided to ATIRS, in the data format of Figures 17-4, 17-5, and 17-6, as applicable, which references the TIR that contains the classified information. AR 380-5 provides instructions on handling classified documents from automated equipment. Since portion markings are not possible on the TIR, the individual blocks in a classified TIR need not be marked provided that:

(1) Classification markings are placed top and bottom.

(2) A statement is included in Block 90 showing the source of the classification, full address of proponent and declassification date/event/Originating Agency's Determination Required (OADR).

(3) A statement is provided in Block 90 listing the classified block numbers and their classification levels. In addition, a statement will be provided to indicate that other blocks not listed are unclassified.

(INSERT FIGURE 17-4)

(INSERT FIGURE 17-5)

(INSERT FIGURE 17-6)

c. It is the responsibility of the originators and recipients to safeguard the classified information per AR 380-5.

d. The program manager should address Operations Security (OPSEC) and Competition Sensitive (CS) implications of TIR information prior to commencement of pretest activities. If the reports are expected to contain OPSEC information, the program manager will notify the document originator, and the ATIRS administrator of any limits to be placed on content, electronic mail distribution, storage, or interactive access per AR 530-1. Similar procedures will be followed for reports expected to contain proprietary or CS information.

e. Access to the ATIRS database is requested through the ATIRS administrator. As a default, government users will have open access to the ATIRS database, unless the data is restricted by the program manager or tester. All contractors are restricted to those data authorized by the program manager or tester. The T&E Manager will have access to all data associated with their commodity command.

17-4. Test Integration Working Group (TIWG) Actions

a. The TIWG plays an active role in developing the T&E program and integrating various disciplines and interest. Therefore, the TIWG is used as the medium to effect necessary actions crucial to the TIR process.

b. To ensure consistency of terms across test phases and milestones, prior to any TIWG the program manager and tester will contact ATIRS either by mail, electronic mail (see paragraph 17-2d for mail and electronic mail addresses), or dial-in/TELNET (after receiving access authorization) for a list of possible values for the TIR blocks shown in paragraphs 17-4c and 17-4d. The list will form the basis for agreement/understanding of values at TIWGs as discussed below.

c. At the initial TIWG meeting, the PM, MATDEV and tester will discuss initiate the following.

(1) Identify all tests which provide data to support a milestone decision. These tests are then reflected in the TEMP and TIRs will be prepared for those tests.

(2) Establish acceptable unique values for the below blocks so that the ATIRS database can be set up for the program (block details in Figure 17-2).

(a) Test Title (Block 2).

(b) System (Block 7).

d. Prior to test, as the program develops, the program manager and tester will lead the following actions in subsequent TIWGs:

(1) Establish unique values to be registered with ATIRS for the following blocks:

(a) Test Agency (Block 5).

(b) Test Sponsor (Block 6).

(c) Model (Block 10).

(d) Manufacturer (Block 13).

(e) Contract NO. (Block 14).

(f) Subsystem (Block 31).

(g) Failure Definition/Scoring Criteria Classification (Block 42).

(h) Chargeability (Block 43).

(2) Establish the format and units of measure to be registered with ATIRS for the following blocks:

(a) Test Life: Units (Blocks 21-25).

(b) Part Life: Units (Blocks 62-64)

(3) Discuss possible data values for use during test as based on the ATIRS listing for the below blocks. Register any additional values with ATIRS. The tester may add other values during conduct of test if the ATIRS listing is insufficient and provided the values are registered with ATIRS.

(a) Action (Blocks 34 and 57).

(b) Categories (Block 46).

(c) Keywords (Block 47).

(d) Test Environment; Type; Condition (Block 48).

(e) Disposition (Block 49)

(f) Type/Level Used/Level Prescribed/Level Recommended (Blocks 80-83).

(4) Discuss security guidance and procedures on data handling.

(5) Determine authorizations and data restrictions (if competition sensitive data are involved) to ATIRS. Fill and submit the ATIRS access authorization form shown in Figure 17-7.

(INSERT FIGURE 17-7)

(6) Establish a distribution list for the TI and CA data for users preferring data to be sent directly from the tester. The list will include format (data stream, TI form format, etc.), distribution method (computer transfers, electronic mail, floppy disk, hardcopy, etc.), and addresses, including electronic mailbox addresses. Users to consider include the program manager, both developmental and operational independent

evaluators/assessors, logistician, combat developer, and T&E Database Manager.

(7) Determine recipients of hard copy information, such as classified photographs or other information related to a TIR.

(8) Determine capabilities/procedures of participants in implementing provisions of this pamphlet (e.g., how contractor TIRs are processed for input to the independent evaluators/assessors and ATIRS administrator).

(9) Determine data collection procedures for all of the test and commodity-unique additions.

17-5. Notifying Database Personnel

a. After the TIWG, the program manager in coordination with the tester must then register the TIWG-agreed acceptable values for the specified blocks in paragraph 17-4 with the ATIRS administrator prior to commencement of testing. Registration is accomplished through either electronic mail, facsimile, or in writing to the ATIRS administrator.

b. All additions to the blocks in the TIR or changes to the TIWG-agreed values must be coordinated with the ATIRS administrator so that consistent, readily identifiable data is stored, retrieved, and used.

17-6. Test Incident Data

a. The tester (government or contractor) prepares the TIR test incident data (i.e. Header blocks 1-8 and Sections I to V of DA Form XXXX-R). ("TIR" used in this section 17-6 refers to just the test incident data sections.) Instructions for completion of TIR input are reflected below. Additionally, Figure 17-2 provides detailed instructions pertaining to each individual TIR block.

b. A TIR is prepared for each test incident occurring on an identifiable test item/system, without regard to the number of times the test incident recurs. Some groupings of incidents are authorized for minor or extremely frequent occurrences that do not impact mission reliability. When an incident involves a problem (such as an inherent operational defect/safety/HFE problems), which does not require maintenance and can be determined by inspection or examination to be common to all samples of the test item that are accessible to the tester, the

tester may prepare a single TIR that addresses the problem, in lieu of a TIR for each test item.

c. A TIR is prepared for test incidents involving government-owned products, such as items covered by a warranty or government-furnished equipment. The MATDEV item manager will prepare a Quality Deficiency Report (QDR), based on the TIR input, per AR 702-7-1. A separate QDR will not be prepared by the tester.

d. A TIR will be prepared whenever the need arises during pretest, test, or post-test activities to report--

(1) Non-receipt of all or part of any applicable test support package or an inadequacy in the components of a support package, in particular, the System Support Package. Also, a TIR will be prepared if the System Support Package Component List is incomplete.

(2) Start of test, to establish a record of the test start date and major component serial numbers (e.g., engine, transmission, etc.) and the starting hours for the major components.

(3) Receipt of materiel in unsatisfactory condition for test.

(4) Any functional area characteristic, defect, or discrepancy, actual or incipient, that affects, may ultimately affect, or pertains to health, safety, environmental, operational suitability or effectiveness, or compliance with contract specifications or requirements documents of the item/system to include its hardware, operator/crew and maintenance personnel, prescribed training, publications, tools, diagnostic and support equipment, and associated software.

(5) The need for or accomplishment of a scheduled preventive maintenance check and service if the maintenance data associated with the task is to be scored as chargeable and scheduled and is to be used in the computation of maintainability statistics for the test.

(6) The need for or accomplishment and/or application or installation of a modification to an end item or it's associated software. Indication will be made in block 90 of the effects on previously reported test conditions.

(7) The need for installation, removal, adjustment,

repair, or replacement of a component, assembly, or software for reasons other than above.

(8) The accomplishment of off-item component or assembly repair, whether accomplished by the tester or by the contractor/manufacturer, on or off the test site, if such maintenance is not reported with the basic incident.

(8) End of test, to establish a record of the test end date and the ending hours for the major components.

e. In addition, TIRs are used to report the following:

(1) A summarization of subtest results (performance, safety/HFE, etc.). In Block 90, a caution "Preliminary Data -- Subject to Further Review" leads into the following format of information: "a. Reference Test Plan, subtest ___, paragraph, ___, dated ___. b. Summary of Results. c. Abbreviated Analysis." The program manager or evaluators may request additional data to be in the TIR if needed.

(2) The achievement of important milestones in the test program, such as receipt or shipment of the test item(s) or commencement or completion of testing, or a specific phase of testing.

f. Each TIR will be assigned a TIR classification value by the tester that reflects the degree of seriousness of the reported incident or test findings, regardless of cause, frequency, or expected probability of occurrence. The four acceptable TIR classification values are: Critical, Major, Minor, and Information and are described as follows:

(1) Critical--

(a) Involves a catastrophic or critical hazard related to health or safety of personnel (death or severe injury or occupational illness; Categories I and II per MIL-STD-882).

(b) Involves a catastrophic safety hazard to the item/system under test (unplanned system loss; Category I per MIL- STD-882).

(c) Reports test results which make test suspension or termination advisable.

(2) Major--

(a) Involves a marginal hazard to health or safety of personnel (Category III per MIL-STD-882).

(b) Involves a critical safety hazard to the item/system under test (unplanned major system damage; Category II per MIL-STD- 882).

(c) Reports the inability of the test materiel (including diagnostic equipment, tools, publications, software, etc.) to meet a critical or essential functional area, design, or performance requirement.

(d) Reports subtest results which reflect inadequate performance.

(e) Involves two or more repetitive minor TIRs in which their cumulated effect could result in any of the above four conditions.

(3) Minor--

(a) Reflects an actual or incipient malfunction, defect, hazard, or negative finding that does not qualify as critical or major.

(b) Reports subtest results which reflect marginal performance.

(4) Information--reports modification to the tested item, current condition of the tested item, test findings, subtest results, safety release information, or other types of information.

g. If the cumulated effect of two or more repetitive minor TIR incidents exhibiting the same manifestations meets the definition for a major TIR, then a major TIR can be written listing the related TIRs. However, each incident will still be reported separately. As additional repetitive incidents occur, this major TIR will be revised to cover the additional incidents. Since it is a derived major TIR, indicate "DERIVED MAJOR" in Block 47.

h. A change or addition to information contained in a distributed TIR (such as a more complete analysis, a description of deferred maintenance, TIR reclassification, incorporation of scoring conference results, or addition of any other data that is

required to complete or update the TIR) will be accomplished by issuing revision(s) to the original TIR. The revision will replace the original TIR (or previous revision(s)) in ATIRS and in any other files (manual or otherwise) that may be created in ATIRS.

i. In revising previously submitted TIR data, the original data must be accounted by reporting in block 90 of the TIR the information which has been revised. Figure 17-2 contains instructions on how to fill in the revision information in Block 90.

j. The basic TIR number is not to be altered; however, block 1 provides for identifying the revision number and date.

k. In those instances where the TIR test incident data is revised to change the TIR incident classification (block 32), block 90 must provide rationale for the change.

l. The tester will electronically transmit the TI data and revisions, if possible, by dial-in or TELNET (provided ATIRS access is authorized) or by electronic mail (atirs@csta-emh1.apg.army.mil) to ATIRS using the data stream specified in Figure 17-5. If a data stream is not possible, then the TIR form of Figure 17-4 (excluding Section VI) may be transmitted. No hardcopy TIRs are to be submitted to ATIRS. In addition, the AMC commodity command T&E Manager will be distributed the TI data IAW Figure 17-4 by electronic mail. Data will also be distributed to other users per agreements reached by TIWG members.

m. In those instances where electronic transmission capability does not exist, tape, floppy disk or other electronic storage media of the test incident or corrective action information will be forwarded by the preparer to ATIRS (same address listed in paragraph 17-2d) for inclusion in the data base. Media compatibility must be verified with the ATIRS administrator. Hardcopy TIRs are not to be submitted to ATIRS.

n. Distribution of TIRs that are prepared for tests other than those identified by the TIWG is limited to the addressees designated by the PM, MATDEV or the tester.

o. The program manager will prepare a listing, using agreements reached by the TIWG members, for distribution of photographs and classified TIRs.

p. Until an automated support system is established to

efficiently process pictures and graphics, transmission of pictures and graphics by facsimile is encouraged.

q. Timeliness of TIRS. To ensure timely receipt of TIRS, the tester will prepare and initiate distribution as follows:

(1) Critical test incidents. The tester notifies the program manager by telephone within 24 hours after detection of the incident. The tester prepares the TIR for distribution as soon as the data has been validated. Critical TIRs are transmitted electronically to the program manager, T&E Manager, higher headquarters test manager, logistician, both the developmental and operational independent evaluators/assessors, and the ATIRS administrator. Electronic message notification does not negate the requirement for accident reporting per AR 385-40.

(2) Major, Minor, and Information test incidents. The tester prepares and distributes the TIR as soon as the data has been validated, after detection of the incident or completion of the subtest.

(3) Revisions to TIRs are distributed as soon as possible after validation of the data by the Data Authentication Group (DAG).

r. When the test materiel is received, if the tester feels it is in an unsatisfactory condition for testing, and believes the condition may jeopardize test objectives, invalidate test results, or render testing unsafe, the tester, after coordination with higher headquarters test manager, should notify the materiel developer by telephone.

(1) If corrections can readily be made with no delay in scheduled test initiation, the tester, after coordination with the higher headquarters test manager, should obtain telephonic concurrence from the program manager and initiate corrective actions or repairs. This means being able to place the item or system in serviceable condition in accordance with the contract specification and standards using available maintenance or repair capabilities. A major TIR will be written.

(2) If corrections cannot readily be made, the tester, after coordination with the higher headquarters test manager, should recommend by phone rescheduling, suspension, or termination of the test. If the test is delayed he should request disposition instructions for the test items from the materiel developer and prepare a critical TIR.

17-7 Corrective Action Data

a. The program manager prepares the corrective action data (Section VI of DA Form XXXX-R) for all TIRs per the instructions contained below. Additionally, Figure 17-3 provides detailed instructions pertaining to each individual corrective action data block.

b. The information will reflect the program managers analysis of the problem, status, and a description of corrective action or a report that no corrective action is proposed, as long as adequate justification is provided.the information. Corrective action data will be prepared with the best information available at the time of preparation, even though the information may be incomplete.

c. Whenever possible, the program manager should implement the necessary corrective actions during the conduct of the planned test program. This provides the evaluator/assessor the opportunity to analyze the corrective action and determine the need for any additional testing, minimizing the need for unplanned additional verification tests or commencement of a new acquisition phase with corrective actions of unknown adequacy. During OT, the configuration is fixed and corrective actions normally are not implemented during its conduct. If a corrective action is implemented during testing, a TIR will be written.

d. Each corrective action taken is assigned a classification value that reflects the status of the corrective action. The classification is determined by a corrective action review team IAW the procedures of paragraph 17-8 below. The four acceptable corrective action status classifications are Open, Completed, Verified, and Not Required and are defined as follows:

(1) Open--corrective action is required but has not been verified or no corrective action has been developed.

(2) Verified--corrective action has not been completed. Corrective action is required and a proposal has been identified, but the corrective action has not been completed.

(3) Completed--corrective action has been completed. Corrective action is required and has been proposed, considered appropriate, implemented, verified by test or analysis as being satisfactory, evaluated for effectiveness, and approved for production.

(4) Not Required--corrective action is not required.

e. The initial corrective action data will be submitted to the ATIRS administrator within 60 days of the date reflected in the TIR release date (block 1 of the TIR). Subsequent updates are submitted as appropriate.

f. A change or addition to previously distributed corrective action information to ATIRS is made through submission of revised data. The revised data replaces the original corrective action information in ATIRS.

g. The corrective action data will be electronically transmitted by dial-in or TELNET (provided ATIRS access is authorized) or by electronic mail (atirs@csta-emh1.apg.army.mil) using the format of Figure 17-6 to ATIRS.

h. When the program manager does not possess electronic distribution capability, the data will be prepared in accordance with the format of Figure 17-6 and will be provided on tape, floppy disk or other electronic storage media to the ATIRS administrator, who ensures input into the database. No hardcopies will be submitted.

i. The program manager will prepare a listing, using agreements reached by the TIWG members, for distribution of basic corrective action data, photographs, classified information or other information related to a corrective action.

j. Distribution of CA data for tests, other than those identified by the TIWG, is limited to the addressees designated by the program manager.

k. Until an automated support system is established to efficiently process picture and graphics, transmission of pictures and graphics by facsimile is encouraged.

l. Upon receiving the corrective action data, ATIRS will automatically assign a CA number to block 45 for tracking of corrective actions. This number will be included whenever the program manager resubmits corrective action data to ATIRS for revision.

17-8. TIR Closure Procedures

a. Critical, major, and minor TIRs will initially be shown in an "OPEN" TIR status in ATIRS. Information TIRs in ATIRS will automatically be in a "PENDING" TIR status and a CA status of "OPEN". TIRs are "CLOSED" upon receipt of a CA status of "COMPLETED". A "VERIFIED" CA status remains an "OPEN" TIR. CA

statuses in ATIRS are changed by submitting a revised CA data stream into ATIRS.

b. A corrective action review team comprised of the program manager, combat developer, operational evaluator, and developmental evaluator/assessor will review all CA data, and associated TIRs, for proper CA categorization. All critical, major, and major-linked repetitive minor TIRs (see paragraph 17-6g for further information on repetitive minor TIRs) must have CA data entered into ATIRS. Critical and major TIRs involving a safety hazard must be coordinated with the safety community before they can be closed.

c. The corrective action review team may be held either in a separate meeting or concurrently during any other convenient meeting where corrective action statuses might be discussed. Telephonic meetings are also acceptable.

d. When any member non-concurs with the proposed CA status decision, the program manager will attempt to resolve the issue; however, if it cannot be resolved he will advise all members of the final decision. The member nonconcurring may raise the issue to the next higher level of management for resolution and will concurrently advise the program manager. ATIRS will reflect an open status until the final decision by the appropriate authority.

e. When the CA status is changed, the program manager will transmit a CA data stream to ATIRS with the CA status information. CA status changes for critical, major, and major-linked repetitive minor TIRs can occur only after:

(1) Appropriate concurrence by the corrective action review team.

(2) Withdrawal of nonconcurrence or resolution by intermediate or final decision authority.

f. Timeliness of CA status change information. In order to affect continuous evaluation, the program manager will submit the changed CA status information to ATIRS as soon as the corrective action review team has decided the change.

TEST INCIDENT REPORT (TIR) DA FORM XXXX-R

TEST INCIDENT REPORT (AR 73-1)	1. Release Date: (MUST FILL)
Test Title: 2. (MUST FILL)	Test Project#: 3. (MUST FILL) TIR#: 4. (MUST FILL)
5. Test Agency: (MUST FILL) 7. System: (MUST FILL)	6. Test Sponsor: (MUST FILL) 8. (NOT USED)

I MAJOR ITEM DATA

10. Model: (MUST FILL)	Test Life: Units:
11. Serial#:	21.
12. USA#:	22.
13. Mfr:	23.
14. Contract#:	24.
15. Item#:	

II INCIDENT DATA

30. Title: (MUST FILL)	40. Date & Time: (MUST FILL)
31. Subsystem: (MUST FILL)	41. FD/SC Step#:
32. Incident Class: (MUST FILL)	42. FD/SC Class:
33. Observed During:	43. Chargeability:
34. Action:	44. Incident Status
35. (NOT USED)	45. Corrective Action#:(RESERVED)
46. Categories 47. Keywords:	
Test Environment: 48. 49. Disposition:	Type: Condition:

III INCIDENT SUBJECT DATA

50. Name: (MUST FILL)	60. FGC:
51. Serial#:	61. LSA#:
52. FSN/NSN:	Part Life Units:
53. Mfr:	62.
54. Mfr Part#:	63.
55. Drawing#:	64.
56. Quantity: (MUST FILL)	65. Next Assy:
57. Action: (MUST FILL)	66. Serial #:
58. (NOT USED)	67. Software Version #:

------------------ IV MAINTENANCE DATA ----------------------
70. Diagnostic Clockhours: 80. Type:
71. Diagnostic Manhours: 81. Level Used:
72. Total Maint Clockhours: 82. Level Prsc:
73. Total Maint Manhours: 83. Level Recm:

--------- V INCIDENT/MAINTENANCE DESCRIPTION ----------------
90. (MUST FILL FIRST LINE)

(MUST FILL)

TIR Number: Page
Number:

(MUST FILL)

Name, Title & Phone of Preparer: 98.	FOR THE COMMANDER: 99.

-------------- VI CORRECTIVE ACTION DATA --------------------

CA Status: 100. (MUST FILL)	Asgd Resp: 101.	CA review team date: 102. (MUST FILL)

120. Developer's Analysis of Problem:
(MUST FILL)

121. Status/Description of Corrective Action:
(MUST FILL)

122. Test Results on Corrective Action:

(MUST FILL)

123. Planned Production Implementation:

(MUST FILL)

Figure 17-1. Sample TIR Form 2134 & 1901

Test incident report (TIR) preparation instructions
test incident (TI) data:

1. INTRODUCTION.

a. This appendix contains the data entry procedures for the test incident data blocks in the TIR (DA Form XXXX-R) (i.e. excluding Section VI - Corrective Action Data) and procedures that should be followed by test planning personnel prior to the start of test. The DA Form XXXX-R is located in Appendix G.

b. General policies, responsibilities, and procedures pertaining to the use of the TIR are contained in AR 73-1 (paragraph 7-12) and DA PAM 73-XX (basic pamphlet, Chapter 12). Test planning procedures are contained herein and as notes in paragraph 2, this appendix. Pagination procedures and procedures for augmenting the format of the TIR are at paragraphs 3 and 4, this appendix, respectively, following the instructions for filling in the DA Form XXXX-R.

c. When adding data into ATIRS using the TIR form, exact placement and field lengths for the data elements must be followed for a successful automated pickup of data. Appendix H contains a template showing the required placements and maximum field lengths.

d. Sections III and/or IV can be omitted if the incident does not involve a part/component or maintenance action.

e. Some or all of the following materials for the item/system under test are required for reference while preparing TIRs:

(1) System Support Package (SSP) Component List.

(2) Technical manuals/equipment publications.

(3) Maintenance Allocation Chart (MAC).

(4) Repair Parts/Special Tools List (RPSTL).

(5) Logistic Support Analysis (LSA) Control Numbers from the LSA Record (LSAR).

(6) Failure Definition/Scoring Criteria (FD/SC).

(7) Technical Bulletin 750-93-1 (Functional Grouping Codes).

2. FILLING IN SECTIONS I TO V OF DA FORM XXXX-R.

Figure 17-2. TIR preparation and TI data.

a. Specific instructions follow for completing each area or section of DA Form XXXX-R.

b. If the values on the form are to be typed, use either 10-pitch or 17-pitch type. Do not mix pitch types; i.e., data in 17-pitch should not be entered on a 10-pitch form.

c. Enter all data either in numbers, upper case letters, or combinations thereof, with the exception of Section V, Incident Description, where upper- and lower-case characters are allowed.

d. Do not leave any blocks blank that are designated "MUST FILL."

e. Left-justify all entries unless otherwise stated in the instructions.

TIR HEADER AREA.

Fill in the TIR header area (Blocks 1 through 7) on every TIR that is prepared.

BLOCK 1. Release Date: (Cols. 59-78, X(20) max)

Enter the date (in DD MMM YYYY format) that the TIR was released for distribution. If a revised TIR is to be issued, change the original release date to the release date of the revision, followed by a space and the phrase REV# and the revision number. Allocate two spaces for the revision number. If only one space is used, fill in the first space with a 0. This is a "MUST FILL" block. Example follows:

Original TIR: 04 AUG 1991

Revised TIR: 06 AUG 1991 REV# 01

BLOCK 2. Test Title: (Cols. 6-39, X(34) max)

Enter the title that has been assigned to this test. This is a "MUST FILL" block.

NOTE: Contact ATIRS for the test title name prior to commencement of testing.

BLOCK 3. Test Project#: (Cols. 45-60, X(16) max)

Enter the test project number that has been assigned for this test. This is a "MUST FILL" block.

NOTE: For tests conducted by U.S. Army Test and Evaluation

Figure 17-2. TIR preparation and TI data.

Command (TECOM) test centers, this will be the TECOM Test Resource Management System (TRMS) number, complete with hyphens but without the test center funding code (e.g., 1-VC-010-577-011). For tests conducted by non-TECOM activities, other project numbers may be applicable. This is a "MUST FILL" block.

BLOCK 4. TIR#: (Cols. 68-77, X(10) max)

Enter the TIR number that has been assigned for this TIR. This is a "MUST FILL" block. Do not change the TIR number (for reasons of TIR revisions, supplementation, or whatever) once it has been assigned.

NOTE: The TIR number is made up of two parts as follows:

a. The first part (first 4 characters) is to identify the TIR as resulting from a specific test by a specific tester, apart from other tests by the same or other tester on a given system or model. The value assigned to this part is to remain constant for the duration of the test and will consist of the following:

(1) The first 2 positions are used to identify the tester. The value to be assigned will be the installation funding code for the tester (if government) or for the program sponsor (if the test is being conducted by a contractor).

(2) The third position is to contain a hyphen (-).

(3) The fourth position is used for a test sequence code (values A through Z) that relates to the number of tests that have been performed by the tester on a given system or model (e.g., assign "A" for the first test of a given system by a given tester).

b. An example of the first part entry for the fifth test at the U.S. Army Combat Systems Test Activity (CSTA) on a given system is K2-E. After the alphabet has been exhausted (excluding "I" and "O"), use the first position from the second part of the TIR number for additional codes (e.g., K2-AC).

c. The second part of the TIR number (up to 6 characters) is used for the unique portion of the number. Normally, the numbering should start with one and be indexed by one for each TIR; however, separate blocks of numbers may be reserved (e.g., for major item types, individual end items, or subsystems) and applied sequentially when desired. Since this field will be sorted upon, do not allow any intermediate positions to be left blank; also, require that all numbers be right-justified and zero-filled.

NOTE: Examples of TIR numbers are:

Figure 17-2. TIR preparation and TI data.

K2-EA00001
KC-A000101

BLOCK 5. Test Agency: (Cols. 19-38, X(20) max)

Enter the name of the test agency (government or contractor) that is responsible for the conduct and reporting of this test. This is a "MUST FILL" block.

NOTE: Contact ATIRS for the exact test agency name prior to commencement of testing.

BLOCK 6. Test Sponsor: (Cols. 59-78, X(20) max)

Enter the name of the program sponsor for this test. The name of the program sponsor should include the office symbol and test sponsor command acronym. This is a "MUST FILL" block.

NOTE: Contact ATIRS for the test sponsor name prior to commencement of testing.

BLOCK 7. System: (Cols. 14-27, X(14) max)

Enter the name of the system which encompasses all major items to be included in the test program. This is a "MUST FILL" block.

NOTE: Contact ATIRS for the system name prior to commencement of testing.

BLOCK 8. (Not Used)

NOTE: This block may be used for additional test-unique or commodity-unique test program data, if desired. See paragraph 4 of this appendix.

BLOCK 9. (See paragraph 4 of this appendix.)

SECTION I, MAJOR ITEM DATA.

Complete this section for every TIR that is prepared. With the exception of Block 10 and possibly Blocks 13 and 14, specific entries in the blocks are applicable only if the TIR applies to a single sample of the major item under test (e.g., an identifiable tank). If the TIR is to apply to more than one sample of the major item, enter an appropriate general response (e.g. ALL, SEE BLOCK 90, OFF-ITEM, N/A, etc.) in each applicable space or leave them blank. If "SEE BLOCK 90" is used, enter the appropriate values in Block 90, either in tabular or narrative form.

NOTE: Test planning personnel must establish acceptable

Figure 17-2. TIR preparation and TI data.

test-unique values for Blocks 10, 13, 14, and 15 and the units for Blocks 21 through 25, as a minimum, prior to commencement of testing.

BLOCK 10. Model: (Cols. 13-38, X(26) max)

Enter the model, type, or series description for the major item to which this TIR applies. This is a "MUST FILL" block.

NOTE: Contact ATIRS for the model name prior to commencement of testing.

BLOCK 11. Serial#: (Cols. 15-38, X(24) max)

Enter the major item serial number, if applicable. If this TIR is being used to document an off-item repair, enter OFF-ITEM in this space.

BLOCK 12. USA#: (Cols. 17-38, X(27) max)

Enter the major item USA registration number (or tail number), if applicable.

BLOCK 13. Mfr: (Cols. 11-38, X(28) max)

Enter the name of the manufacturer of the major item, if known.

NOTE: Contact ATIRS for the manufacturer name prior to commencement of testing.

BLOCK 14. Contract#: (Cols. 17-38, X(22) max)

Enter the contract number, purchase order number, or document number that pertains to the obtainment of the major item, if known.

NOTE: Contact ATIRS for the contract number prior to commencement of testing.

BLOCK 15. Item#: (Cols. 13-38, x(26) max)

Enter the code that has been assigned to the end item, group of test items, or type of data against which this TIR is being written.

NOTE: This block is to be used by the tester to assign test unique codes in any way he sees fit to enable easier tracking of data. In general, test planning personnel should establish acceptable test-unique item number codes prior to the start of test. Begin by determining whether all end items to be tested are to be of the same group within the system or of different

Figure 17-2. TIR preparation and TI data.

groups. Then identify each end item to be tested in each group and assign a unique item number code for each end item. Also assign additional item number codes for any specific types of data that are to be recorded as pertaining to all items within a specific group (e.g. PUBS for publication comments).

When assigning these codes, consider how the test data is desired to be stored and retrieved. If data from one or more groups of end items are to be retrieved and/or consolidated, consider using the first character(s) of the code as part of the data retrieval selection criteria.

BLOCKS 16 to 20. (See paragraph 4 of this appendix.)

BLOCKS 21, 22, 23, 24 and 25. Test Life: (Cols. 45-54, X(10) max)
Units: (Cols. 57-71, X(15) max)

Enter the test life of the major item at the time of the incident and its corresponding units of measure. Up to five types of major item test life may be entered.

NOTE: Contact ATIRS for the test life format and units prior to commencement of testing.

Examples of units of measure are miles, kilometers, rounds fired, flight hours, etc., or abbreviations thereof. Test planning personnel should assign a specific unit of measure to each block for the duration of test, together with required spacing, justification, and composition of the test life and unit of measure entries. If a life period other than test life is to be recorded, so indicate (e.g., TOT ODOM MILES).

BLOCKS 24 to 29. (See paragraph 4 of this appendix.)

SECTION II, INCIDENT DATA.

Complete this section for every TIR that is prepared. The blocks in this section pertain to summary information and basic incident data, to include the various classifications of the TIR and its scoring. Values entered in Blocks 32 and 41 through 43 should be treated as preliminary when the TIR is first prepared. After the TIR has been scored at the RAM scoring conference or during the TIR closure process, submit a revised TIR revising the values entered in Blocks 32 and 41 through 43 as necessary to reflect the various conference agreements. The status of this scoring will be reflected in BLOCK 44.

NOTE: Test planning personnel will establish acceptable test-unique values for Blocks 31, 34, 41, 42, 43, 46, 47 and

Figure 17-2. TIR preparation and TI data.

possibly 48 and/or 49 prior to commencement of testing.

BLOCK 30. Title: (Cols. 13-38, X(26) max)

Enter a title for the TIR or a brief summary of the information that is to be contained therein. This is a "MUST FILL" block. Be sure to stay within the space allowed.

BLOCK 31. Subsystem: (Cols. 17-38, X(22) max)

Enter the name of the subsystem to which this TIR is to be chargeable. This is a "MUST FILL" block.

NOTE: Contact ATIRS for a list of subsystem names prior to commencement of testing. The major item name and NONE should also be included as acceptable values.

BLOCK 32. Incident Class: (Cols. 22-33, X(12) max)

Enter the classification that is to be assigned to this TIR. Refer to DA PAM 73-XX (basic pamphlet, paragraph 17-6f) for directions as to what entries are applicable. This is a "MUST FILL" block. The only acceptable values are:

CRITICAL	MAJOR	MINOR	INFORMATION

BLOCK 33. Observed During: (Cols. 23-38, X(16) max)

Enter the word or phrase that best describes the activity that was taking place when the event occurred that prompted the preparation of this TIR.

NOTE: Examples of typical test activity entries are:

INIT INSPECTION	RAM-D	SAFETY EVAL
OPERATION	INSPECTION	NON-MISSION
MAINTENANCE	TRANSPORT	DESK AUDIT
LOG EVAL	PERF EVAL	ENV EVAL

BLOCK 34. Action: (Cols. 14-38, X(25) max)

Enter the word or phrase that best describes any action that was taken on the major item following the event or incident.

NOTE: Contact ATIRS for other acceptable values in addition to the below examples prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of entries for actions taken on the major item are:

CLEARED	MAINTAINED	SUSPENDED TEST

Figure 17-2. TIR preparation and TI data.

OPERATED DEFERRED MAINTENANCE NONE

BLOCKS 35 to 39. These blocks may be used for added test-unique or
commodity-unique incident or scoring data, if desired. See paragraph 4 of this appendix.

BLOCK 40. Date & Time: (Cols. 58-77, X(20) max)

Enter the date and time when the event occurred that prompted the preparation of this TIR. In the case of a TIR reporting a failure, malfunction, discrepancy, defect, maintenance task, or hazard, this will be the date and time that the problem or event occurred, began, or was detected. For other TIRs, this will be the date and time associated with determination of the need for the TIR, assuming that the requisite information is available. This is a "MUST FILL" block. Format for entry is day, month, year (DD MMM YYYY), 24-hour time, and time standard (e.g., 02 AUG 1991 1315 EST). Do not attempt to list a range of dates or multiple dates. Time and time standard may be omitted, if not known.

BLOCK 41. FD/SC STEP#: (Cols. 58-77, X(20) max)

Enter the step number from the FD/SC decision tree flow chart for the test that best describes the rationale for the scoring of this TIR.

BLOCK 42. FD/SC Class: (Cols. 58-77, X(20) max)

Enter the FD/SC classification that is to be assigned to this TIR.

NOTE: Contact ATIRS for exact acceptable values prior to commencement of test.

NOTE: Examples of typical FD/SC classification entries are:

NO TEST	NON-RAM	SMA	MAF/MA
UMA	EMA/UMA	OMF/EMA/UMA	

BLOCK 43. Chargeability: (Cols. 60-77, X(18) max)

Enter the FD/SC chargeability that is to be assigned to this TIR.

NOTE: Contact ATIRS for exact acceptable values prior to commencement of test.

NOTE: Examples of typical FD/SC chargeability entries are:

Figure 17-2. TIR preparation and TI data.

HARDWARE	TRAINING	ENVIRONMENT
SOFTWARE	PUBLICATIONS	TEST CONDUCT
OPERATOR/CREW	SUPPORT EQUIP	GFE
MAINT PERSONNEL	MAINT HARDWARE	NONE

BLOCKS 44. Incident Status: (Cols. 62-73, X(12) max)

Enter the status that describes the method of arriving at values for Blocks 32 and 41 through 43. If the tester scored the data, enter PRELIMINARY. Enter SCORED if a formal committee such as a RAM Scoring Conference scored the data. Enter ASSESSED if a formal committee such a RAM Assessment Conference scored the data.

Status entries are:

PRELIMINARY	SCORED	ASSESSED

BLOCK 45. Corrective Action#: RESERVED

This is a reserved field. ATIRS will computer generate the value for this field.

BLOCK 46. Categories: (Cols. 18-31, X(14) max
33-46, X(14) max
48-61, X(14) max
63-76, X(14) max)

Enter the word or phrase from the following list that best describes the categories or test issues associated with this TIR. All applicable categories will be submitted, with the primary category listed first. Acceptable values are shown below.

Acceptable values are:

PHYSICAL	HUMAN FACTORS	CORROSION
SAFETY	O&O	TEST ADMIN
PERFORMANCE	TRAINING	SOFTWARE
RAM	ENVIRONMENTAL	LOG SUPPORT

NOTE: Contact ATIRS for other possible acceptable categories in addition to the above listed prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

BLOCK 47. Keywords: (Cols. 18-31, X(14) max
33-46, X(14) max
48-61, X(14) max
63-76, X(14) max)

Enter the word or phrase of vital importance. All applicable

Figure 17-2. TIR preparation and TI data.

keywords will be submitted, with the primary keyword listed first.

NOTE: Before using these keyword blocks, contact ATIRS for a list of presently used keywords prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

BLOCK 48. Test Environment: (Cols. 6-37, X(32) max)

Describe the test environment that existed when the event occurred that prompted preparation of this TIR. Use this space for information in addition to that which was entered in Block 33 (Observed During). When applicable, cite the appropriate paragraph of a military standard or specification in this space. For operational tests, this block normally contains the mission profile that the system was performing at the time the incident occur.

NOTE: Contact ATIRS for other acceptable values in addition to those listed below prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of test environment values are:

Developmental Tests:

AUTOMOTIVE PERFORMANCE
ARMAMENT TEST
ELECTRICAL SYSTEM TEST
HIGH TEMPERATURE CHAMBER

Operational Tests:

MISSION No: XXXXXXXX

Type: (Cols. 39-60, X(22) max)

Enter the environment type that best describes the type environment in whichthe test is being conducted.

NOTE: Coordinate with ATIRS for a list of presently used phrases/words and to add any other phrases/words to the list.

NOTE: Examples of environment type values include:

PAVED	HILLY CROSS COUNTRY	VIBRATION
GRAVEL	SWAMP/MUD/HOG WALLOW	FUEL CONSUMPTION
WASHRACK	HORIZONTAL SLOPE	OBSTACLES
BELGIAN BLOCK	SIDE SLOPE	DYNAMOMETER
FORDING BASINS	ENVIRONMENTAL CHAMBER	FIRING RANGE
LABORATORY	MAINT/REPAIR SHOP	NA

Figure 17-2. TIR preparation and TI data.

Condition: (Cols. 62-77, X(16) max)

Enter the environment condition that best describes the condition of the environment in which the test is being conducted.

NOTE: Coordinate with ATIRS for a list of presently used phrases/words and to add any other phrases/words to the list.

NOTE: Examples of typical environment condition values include:

DRY	DUSTY	HEAVY MUD	ICE AND SNOW
ICE	SNOW	LIGHT MUD	WET
WET SNOW	ICE FOG	SAND	NA

BLOCK 49. Disposition: (Cols. 19-77, X(59) max)

Enter the word or phrase that best describes disposition of any defective (failed) materiel that pertains to this TIR.

NOTE: Contact ATIRS for other acceptable values in addition to those listed below prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of typical disposition values include:

AWAITING INSTRUCTIONS	INSTALLED/REINSTALLED
TO BE HELD UNTIL (date)	SCRAPPED
HELD FOR FAILURE ANALYSIS	REWORKED
TURNED IN TO SUPPLY	CANNIBALIZED
FORWARDED TO HIGHER LEVEL MAINTENANCE	MISSING/LOST
RETURNED TO (contractor name)	OTHER/SEE BLOCK 90
RETURNED TO (sponsor name)	NOT APPLICABLE
SHIPPED PER SPONSOR INSTRUCTION	

SECTION III, INCIDENT SUBJECT DATA.

The blocks in this section provide for the description of the TIR subject part or assembly (if any) and its next higher assembly. Complete this section if the TIR pertains in any way to an identifiable part or assembly, a major subassembly or subsystem, the major item itself, or a component of its SSP. If the subject of the TIR is to be a group of parts or assemblies of a given type, make sure that all entries to be made in the various blocks apply to the entire quantity that is being described. If the parts or assemblies in the group have different values (e.g., serial numbers, part numbers, part lives, etc.), enter an appropriate general response (e.g., SEE BLOCK 90, N/A, etc.) in each applicable space or leave blank. Regardless of whether a part or a group of parts are of concern, provide in

Figure 17-2. TIR preparation and TI data.

Block 90 a tabulation of the parts used. Detailed instructions are provided in the Block 90 instructions below. Because Section III contains summaries of data, its blocks should not be used to count parts without close deliberations.

BLOCK 50. Name: (Cols. 17-38, X(27) max)

Enter the name of the part or assembly being described as the TIR subject. Obtain it from the RPSTL. This is a "MUST FILL" block if Section III is used.

BLOCK 51. Serial#: (Cols. 15-38, X(24) max)

Enter the serial number, lot number, or batch number for the item named in Block 50.

BLOCK 52. FSN/NSN: (Cols. 15-38, X(24) max)

Enter the Federal/National Stock Number for the item named in Block 50. Obtain it from the RPSTL.

BLOCK 53. Mfr: (Cols. 11-38, X(28) max)

Enter the name of the manufacturer that built or produced the item named in Block 50, if known or enter the Federal Supply Code of Manufacturer (FSCM) code from the RPSTL. Abbreviate as required.

BLOCK 54. Mfr Part#: (Cols. 17-38, X(22) max)

Enter the manufacturer's part number for the item named in Block 50. Obtain it from the RPSTL or from the part or assembly itself.

BLOCK 55. Drawing#: (Cols. 16-38, X(23) max)

Enter the drawing number for the item named in Block 50, if available.

NOTE: If desired, figure and item number references from the appropriate RPSTL may be entered in this block in lieu of a drawing number.

BLOCK 56. Quantity: (Cols. 16-25, X(10) max)

Enter the quantity of the items that have been named in Block 50. Refer to the introductory instructions for Section III if the entry is to be greater than one. The number entered should be right justified. This is a 'MUST FILL" block if Section III is used.

Figure 17-2. TIR preparation and TI data.

BLOCK 57. Action: (Cols. 14-38, X(25) max)

Enter the word or phrase that best describes what was done to the part or assembly named in Block 50 following the event or incident. Enter NONE if no action was taken. This is a 'MUST FILL" block if Section III is used.

NOTE: Contact ATIRS for other acceptable values in addition to the below examples prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of entries for actions taken on a part or assembly are:

INSPECTED	CHANGED MISSION PROFILE	CLEARED
TESTED	DIAGNOSED	DRAINED
SERVICED	OPERATED	FLUSHED
ADJUSTED	LUBRICATED	PURGED
ALIGNED/REPOSITIONED	DISASSEMBLED/ASSEMBLED	LOADED
CALIBRATED	REMOVED	ADDED
INSTALLED	MODIFIED	CHARGED
REPLACED	TORQUED/TIGHTENED	SLAVED
DISCONNECTED	REMOVED/REINSTALLED	UNLOADED
REPAIRED	SAMPLED OIL/FLUID	CLEANED/WASHED
OVERHAULED	SAFETY WIRED/SECURED	HANDLED/JACKED
REBUILT	PAINTED/CURING/DRYING	NONE

BLOCK 58. (Not used)

NOTE: This block may be used for additional test-unique or commodity-unique test program data, if desired. See paragraph 4 of this appendix.

BLOCK 59. (See paragraph 4 of this appendix.)

BLOCK 60. FGC: (Cols. 50-77, X(28) max)

Enter the Functional Group Code (FGC) and/or the name of the functional group to which the item named in Block 50 belongs. Obtain it from the RPSTL, MAC, or TB 750-93-1.

BLOCK 61. LSA#: (Cols. 51-77, X(27) max)

Enter the LSA Control Number for the item named in Block 50, if applicable. Obtain it from the LSAR for the system, if available.

BLOCKS 62, 63, and 64. Part Life: (Cols. 45-54, X(10) max)

Figure 17-2. TIR preparation and TI data.

Units: (Cols. 57-71, X(15) max)

Enter the true life, if known, of the item named in Block 50 and its corresponding units of measure. If true life is unknown, enter test life. If the part or assembly is new, enter 0 (zero). Up to 3 types of part life may be entered.

NOTE: Contact ATIRS for the part life format and units prior to commencement of testing.

Test planning personnel should either assign a specific unit of measure to each block for the duration of test (the same as for Blocks 21, 22, 23, 24, or 25) or designate one or more units of measure to be used with specific parts, assemblies, or subsystems of the major item (i.e., the most appropriate units). Required spacing, justification, and composition of the part life and unit of measure entries should also be assigned. The program manager should provide part life data if this data is not known.

BLOCK 65. Next Assy: (Cols. 56-77, X(22) max)

Enter the name of the next higher assembly to the item named in Block 50. Obtain it from the RPSTL. The program manager should provide this information if the RPSTL does not exist.

BLOCK 66. Serial#: (Cols. 54-77, X(24) max)

Enter the serial number, if applicable, of the item named in Block 65.

BLOCK 67. Software Version#: (Cols. 64-77, X(14) max)

Enter the computer configuration item name when Categories (Block 46) or Chargeability (Block 43) is SOFTWARE.

BLOCKS 68 and 69. (See paragraph 4 of this appendix.)

SECTION IV, MAINTENANCE DATA.

This section is used for summarizing data from all applicable maintenance tasks or actions that were performed on the end item identified in Block 10 as a result of the event or incident being described on this TIR. Complete this section if maintenance was performed. If maintenance is known to be required but is not performed immediately, complete this section with all available known data, leaving the remaining spaces blank. When the maintenance is eventually performed, revise and update the data in this section and on the remainder of the TIR to reflect the additional information learned during the maintenance. Provide in Block 90 a tabulation of the clock hours and manhours by maintenance level and type. Detailed instructions are provided

Figure 17-2. TIR preparation and TI data.

in the Block 90 instructions below. Because the blocks in Section IV contain summaries of data, they should not be used to calculate supportability indices (e.g. mean time to repair (MTTR), maintenance ratio (MR), etc.) without close deliberations.

NOTE: The tester establishes acceptable test-unique values for Blocks 80 through 83 through the TIWG process.

BLOCKS 70 and 71. Diagnostic Clockhours/Manhours: (cols. 31-37, X(7)max)

Enter the clockhours and manhours required to perform the diagnostic (fault location) portion of maintenance for all tasks or actions described on this TIR, regardless of maintenance level. Data is to be reported in the format HHHH:MM.

BLOCKS 72 and 73. Total Maint Clockhours/Manhours: (cols. 31-37, X(7)max)

Enter the clockhours and manhours required to perform all maintenance for all tasks or actions being described on this TIR, regardless of maintenance level. Include all diagnostic time from Blocks 70 and 71. Data is to be reported in the format HHHH:MM.

BLOCKS 74 to 79. (See paragraph 4 of this appendix.)

BLOCK 80. Type: (Cols. 51-77, X(27) max)

Enter the word or phrase that best describes the type of maintenance that was performed. Make sure that the entry does not conflict with any scoring entered in Blocks 41 through 43.

NOTE: Contact ATIRS for range of possible other values than those in the below examples prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of entries for maintenance type are (try to limit to these listed):

UNSCHEDULED	ESTIMATED
SCHEDULED	SIMULATED
NO TEST	

BLOCK 81. Level Used: (Cols. 57-77, X(21) max)

Enter the name of the highest maintenance level that was actually used to perform any of the maintenance being described on this TIR.

Figure 17-2. TIR preparation and TI data.

BLOCK 82. Level Prsc: (Cols. 57-77, X(21) max)

Enter the name of the highest maintenance echelon prescribed in the MAC which should have been used during this incident. Stated another way, this is the lowest maintenance level that is prescribed in the MAC or technical manuals as being authorized to perform all of the maintenance being described on this TIR. If no level is prescribed, enter NONE or UNKNOWN, as applicable.

BLOCK 83. Level Recm: (Cols. 57-77, X(21) max)

Enter the name of the maintenance level that the tester recommends for this maintenance, if different from the prescribed level entered in Block 82.

NOTE: Contact ATIRS for possible other values for blocks 81 to 83 than those in the below examples prior to commencement of test. Other values may be added by registering them with the ATIRS administrator.

Examples of acceptable maintenance level entries in hierarchical order for Blocks 81 to 83 are:

For Non-Aviation Systems:

CREW/OPERATOR
ORGANIZATIONAL
ORG/DS ASSIST
MFR ORGANIZATIONAL
DS/ORG ASSIST
DIRECT SUPPORT

MFR DIRECT SUPPORT
MFR CONTACT TEAM
GENERAL SUPPORT

MFR GENERAL SUPPORT
SPECIAL REPAIR ACTY
DEPOT
MFR/UNKNOWN LEVEL

For Aviation Systems:

CREW/OPERATOR
UNIT (AVUM)
AVUM/AVIM ASSIST
MFR AVUM
AVIM/AVUM ASSIST
INTERMEDIATE (AVIM)/DS

MFR AVIM/DS
MFR CONTACT TEAM
INTERMEDIATE (AVIM)/GS

MFR AVIM/GS
SPECIAL REPAIR ACTY

MFR/UNKNOWN LEVEL

Values of NONE and UNKNOWN are also acceptable for Block 82 but should not be used with Blocks 81 or 83.

BLOCKS 84 to 89. (See paragraph 4 of this appendix.)

SECTION V, INCIDENT/MAINTENANCE DESCRIPTION.

Complete this section for every TIR that is prepared. The use of upper and lower-case letters in Block 90 is permitted and encouraged.

Figure 17-2. TIR preparation and TI data.

Section V may be totally free form, or Blocks 91 through 97 may be added. If desired, it may be composed of several preprogrammed elements from other data entry systems (e.g., short narrative, full description, and tabulated fillers and spaces for maintenance subtasks performed, parts used, tools used, etc.).

BLOCK 90:

First line: (Cols. 6-77, X(72) max)

Start the first line in Column 6 on the same line as the number "90." On the remainder of the line, enter a brief summary of the incident that is being described on this TIR. For example, "TRANSMISSION CLUTCH PACK WORN, NO REVERSE, FAULT LOCATION ONLY" OR "Transmission removed and replaced because of worn clutch pack." Be sure to stay within the space allowed on the line. This is a "MUST FILL" line.

Subsequent lines: (Cols. 2-77, X(76) max)

On subsequent lines, fully describe the incident or event and any resultant maintenance tasks. This is a "MUST FILL" block. Use as many lines as are necessary and continuation sheet(s), if required. Use complete sentences and proper paragraph structuring, numbering, and indentation. Enter table headings and values as required to amplify the narrative. Use footnotes, if applicable. If desired, skip lines to separate paragraphs, space tables and table headings, and isolate footnotes. Based on the testers facts provide information to as many of these questions as possible: What happened? How did it happen? How was it discovered? Where did it happen? Under what conditions did it happen? Why did it happen? What actions, if any, were taken? Include additional description in instances where entries made in Sections I through IV require further clarification. Include reasons and/or justification for incident classification assignments and scoring if they are not self-explanatory.

For TIRs pertaining to an accident or environmental release, describe any resultant injuries or property damage. Include the word "safety" or "health" and a risk assessment code (e.g. Cat I-A) per MIL-STD-882, if applicable.

Whenever possible, indicate if the cause of the incident or event is improper design (e.g. improper material, overstressing, interfering parts, or other design problems) or improper manufacture. Describe any positive actions or suggested solutions which appear capable of correcting the problem or would prevent future incidents of this type from occurring.

TIRs which report subtest results will identify the name of the individual subtest and reflect the following:

Figure 17-2. TIR preparation and TI data.

a. Test Findings: State the test results. Discuss the analytical procedures used and test measurement accuracy. Ensure that only factual data are contained in this paragraph.

b. Technical Assessment: Discuss the significance of the test results. Describe what engineering judgments were made. Analyze the test results relative to criteria compliance. Discuss any significant problems, corrective actions, or suggested improvements.

Reference any hard-copy reports, sketches, photographs, or correspondence containing classified information on the incident or event that are being forwarded separately. Do not include any classified information in this block or, for that matter, in any other block on the TIR.

Revise or update this description as more information becomes available or if additional maintenance tasks are performed as a result of the event or incident. Identify revised information with the heading on a separate line: "Revision", the date of the revision, and test life. Enter the name of the person who is responsible for the revised information, if other than shown in Block 98. The test director is the ultimate responsible person for any TIR changes. For each TIR revision involving changes to data in Sections I through IV, enter a brief description of the changes and the reason(s) for the changes. All original data are retained during TIR revision to insure data integrity. Revisions may (1) add data or (2) change erroneous data by citing the old and adding the correction.

Maintenance Time Information:

After the description narratives, provide a tabulation of maintenance time information for the maintenance actions performed as follows: maintenance level/echelon, maintenance type, clockhours, and manhours. Begin the maintenance time information with "MAINTENANCE TIME BREAKDOWN" centered in the TIR form. Use the following header conventions in naming the columns:

Content:	Header:	Maximum Length	Beginning Position:
Date maintenance started (YYMMDD)	DateSt	6	2
Date maintenance ended (YYMMDD)	DateEd	6	9
Time started (4-digit 2400 hour ck format)	TmSt	4	16
Time ended (4-digit 2400 hour clock format)	TmEd	4	21
Maintenance level/echelon	Level	5	26
Administrative and logistic			

Figure 17-2. TIR preparation and TI data.

delay hours	Delay	6	32
Maintenance type		4	39
Diagnostic clockhours	Dgchrs	6	44
Total maintenance clockhours	Tmchrs	6	51
Diagnostic manhours	Dgmhrs	6	58
Total maintenance manhours	Tmmhrs	6	65
Applicable (Y) or not applicable (N)	App	1	73

Clockhour and manhour field lengths are as specified in Blocks 70-73.

The maintenance level content is to contain no more than 5 characters. The maintenance type content is to contain no more than 4 characters. The characters allowed for these values are less than those allowed for Blocks 80 and 81 because of the use of abbreviations to save space. The applicable time (App) is a marker that can be used to denote which maintenance periods are applicable for calculating supportability indices.

Use the following abbreviations for the more common maintenance levels:

CREW - Crew
ORG - Organizational
DS - Direct Support
GS - General Support
AVUM - Aviation Unit Maintenance
AVIM - Aviation Intermediate Maintenance
SRA - Special Repair Activity
DEPOT - Depot
CONTR - Contractor

Use the following abbreviations to indicate the more common maintenance types:

NT - No Test
U - Unscheduled maintenance action
S - Scheduled maintenance action
EST - Estimated maintenance action
SIMU - Simulated maintenance action

Part Information:

After the description narratives, provide a tabulation of parts used. Begin the part information with "PARTS REPLACED DATA" centered in the TIR form. Provide the following part information: nomenclature; FGC; numerical identification(s) such as the serial number, FSN/NSN, or manufacturer part number (whichever is available for the test item); part life; maintenance level/echelon prescribed for replacement; quantity; and action taken on the part. The program manager will provide

Figure 17-2. TIR preparation and TI data.

the part information to the tester if information is lacking to complete the part information on a TIR. Use the following header conventions in naming the columns:

Content:	Header:	Maximum Length:	Beginning Position:
Nomenclature		19	2
FGC		4	22
Serial number	Serial#	24	27
FSN/NSN	FSN/NSN	24	27
Manufacturer number	MfrPart#	22	27
Part life	PartLife	7	52
Maintenance level/echelon	Level	4	61
Quantity	Qty	4	67
Action		7	72

The number of characters allowed is to be no longer than those specified for the corresponding blocks in Section III and, depending on actual information content, can be even shorter. The nomenclature content is to contain no more than 19 characters. The FGC code is to be only 4 characters long (the requirement of 28 spaces for Block 60 on the FGC information is to allow a descriptive name for the functional group). The units for the part life will be the same as in Block 62.

BLOCKS 91 through 97: (See paragraph 4 of this appendix.)

TIR SIGNATURE BLOCK AREA.

Fill in the signature block area (Blocks 98 and 99) on every TIR that is prepared. Each signature block may be three lines maximum, X(34) maximum per line. Leave one blank line between the command line and the names of the individuals.

NOTE: Test planning personnel should establish acceptable entries for some, if not all, of the information to be entered in Blocks 98 and 99 prior to commencement of testing.

BLOCK 98. Name, Title, & Phone of Preparer:
(Cols. 6-39, X(34) max)

Enter the name, title, and telephone number of the person responsible for the content and validity of the information in this TIR.

BLOCK 99. FOR THE COMMANDER:
(Cols. 45-78, X(34) max)

Enter the release signature block as required by the tester.

Figure 17-2. TIR preparation and TI data.

NOTE: This is the end of the Test Incident Data Portion of the TIR. Do not enter anything after Block 99 other than a line of hyphens and the form identification phrase.

3. PAGINATION PROCEDURES.

Page breaks are unnecessary in TIRs that are distributed electronically, but may be present when hard copy distribution is being made. The location of the page break is left to the discretion of the preparer. Ideally, the page break should not leave a section title on one page and begin the data on the next.

At the desired page break, end the page with the following line:

|------------- (continued on next page)--------------------|

Start each new page with the following header:

TIR Number:	Page Number:

Regardless of the number of pages, always end the TIR with the signature blocks (Blocks 98 and 99), the row of hyphens, and the form identification phrase.

4. DA FORM XXXX-R AUGMENTATION PROCEDURES.

a. The DA Form XXXX-R is a sequenced set of standardized record formats, each format containing either predetermined fillers or a combination of fillers and spaces for entering data. The form may be subjected to automated document processing. Successful processing by the method being used depends upon rigid adherence to the record sequence and the use and content of each record format.

b. During processing, the computer will look for particular data elements in specific locations on the form as depicted by the fillers. Therefore, fillers on the DA Form XXXX-R must not be altered with respect to location or content, and the locations and field lengths of the blocks for entering data should not be changed.

c. Limited provisions have been made to allow for tailoring of the DA Form XXXX-R by test planning personnel to accommodate test- or commodity-unique data entry blocks. The following locations contain unused spaces that may be used:

Figure 17-2. TIR preparation and TI data.

(1) In the TIR Header Area on the line containing Block 7, Block 8 may be used for added test program descriptor data. Following that line, a line containing Block 9 may be inserted for still more test program data.

(2) In Section I, Blocks 16 through 20 and 26 through 29 may be inserted for still more major item data.

(3) In Section II on the lines containing Blocks 36 through 39 may be used for added test-unique or commodity-unique incident or incident scoring data.

(4) In Section III following the line containing Blocks 58 and 67, lines containing Blocks 59, 68, and 69 may be inserted for added data pertaining to the incident subject. Block 58 may be used for added test-unique or commodity unique incident or incident scoring data.

(5) In Section IV following the line containing Blocks 73 and 83, lines containing Blocks 74 through 79 and 84 through 89 may be inserted for added types of maintenance data.

(6) In Section V, Blocks 91 through 97 may be added.

d. All additions should be coordinated with the ATIRS administrator prior to the start of test. Except for the TIR Header Area, all added lines for added data blocks should be consecutively numbered in the left-hand margin. New blocks should be added in pairs on a line-by-line basis. Also, all additions must be placed before the TIR Signature Block Area.

e. Data collection procedures for all test-unique and commodity-unique additions should also be established and disseminated prior to start of test.

Figure 17-2. TIR preparation and TI data.

Figure 17-3. Test incident report (TIR) preparation instructions corrective action (CA) data.

1. INTRODUCTION.

a. This appendix contains the data entry procedures for Section VI of the TIR (DA Form XXXX-R) and procedures that should be followed by materiel proponent planning personnel prior to the start of testing. The DA Form XXXX-R is located in Appendix G.

b. General policies, responsibilities, and procedures pertaining to the use of the corrective action section of the TIR are contained in DA PAM 73-XX (basic pamphlet, paragraph 17-7).

2. FILLING IN SECTION VI of DA FORM XXXX-R.

a. Specific instructions follow for completing each area or section of DA Form XXXX-R.

b. Enter all data either in numbers, upper-case letters, or combinations thereof, with the exception of Blocks 120-123, which can be upper- and lower-case letters.

c. Do not leave any blocks blank that are designated "MUST FILL".

d. Left-justify all entries unless otherwise stated in the instructions.

BLOCK 100. CA Status: (MUST FILL) (Cols. 7-16, X(10) max)

Enter OPEN, VERIFIED, COMPLETED, or PENDING, indicating the status of the corrective action the program sponsor must take as a result of a critical or major test incident. This is a "MUST FILL" block.

BLOCK 101. Asgd Resp: (Cols. 31-48, X(18) max)

Enter the organization from the following list that best describes the tester's knowledge of who should be assigned responsibility for the corrective action. The only acceptable values are:

TESTER	MATERIEL DEVELOPER	NONE
TRAINER	COMBAT DEVELOPER	
OTHER	ALL	

Block 102. Corrective action review team date: (Cols. 56-66, X(11) max)

Enter the day, month, and year in DD MMM YYYY format that the

Figure 17-3. TIR preparation and CA data.

corrective action review team met to decide the corrective action status change in Block 100. If the TIR is closed without a corrective action review team (as provided with minor TIRs not linked to a major TIR), then enter NONE. If a meeting to close TIRs did not occur, then use the date when final coordination was achieved by other means such as correspondence or phone conversations. This is a "MUST FILL" block.

BLOCKS 120-123. (Cols. 2-78, X(77) max)

Space is provided for entering four different types of narratives that pertain to the corrective action. The four narrative types, together with their respective block numbers, are as follows:

120. Developer's Analysis of Problem.
121. Status/Description of Corrective Action.
122. Test Results on Corrective Action.
123. Planned Production Implementation.

Enter the block number and the title for the type of narrative that is being addressed; then prepare and enter the narrative. The use of upper and lower-case letters is permitted and encouraged. Use complete sentences and proper paragraph structuring, numbering, and indentation. Enter table headings and values as required to amplify the narrative. Use footnotes, if applicable. If desired, skip lines to separate paragraphs, space tables and table headings, and isolate footnotes.

Use as many lines as are necessary for each narrative type. Complete one narrative and add a line of dashes before beginning another narrative. Do not attempt to continue a specific narrative on another page following a subsequent narrative. Keep the narratives in order by block number. Each of the narratives are "MUST FILL" blocks.

Limit the narratives to the corrective action and related incident reports. Reference any hard-copy reports, sketches, photographs, or correspondence containing classified information that are being forwarded separately. Do not include any classified information in the narratives or, for that matter, in any other blocks.

Revise or update the narratives as more information becomes available.

Figure 17-3. TIR preparation and CA data.

Figure 17-4. Test incident report (TIR) field placements and allowable lengths.

```
------------------------------------------------------------
TEST INCIDENT REPORT (AR 73-1)  1. Release Date: XXXXXXXXX
------------------------------------------------------------
 Test Title:          Test Project#:      TIR#:
2. XXXXXXXXXXXXXX   3. XXXXXXXXXXX      4. XXXXXXXXXX
------------------------------------------------------------
5. Test Agency: XXXXXXXX   6. Test Sponsor: XXXXXXXXXXXX
7. System: XXXXXXXXXXXXX   8. (NOT USED)
------------------- I  MAJOR ITEM DATA ---------------------
10. Model: XXXXXXXXXXXXX      Test Life:  Units
11. Serial#: XXXXXXXXXXX   21. XXXXXXXXX  XXXXXXXXXXX
12. USA#: XXXXXXXXXXXXXX   22. XXXXXXXXX  XXXXXXXXXXX
13. Mfr: XXXXXXXXXXXXXXX   23. XXXXXXXXX  XXXXXXXXXXX
14. Contract#: XXXXXXXXX   24. XXXXXXXXX  XXXXXXXXXXX
15. Item#: XXXXXXXXXXXXX   25. XXXXXXXXX  XXXXXXXXXXX

------------------- II  INCIDENT DATA ----------------------
30. Title: XXXXXXXXXXXXX   40. Date & Time:   XXXXXXXXX
31. Subsystem: XXXXXXXXX   41. FD/SC Step#:   XXXXXXXXX
32. Incident Class: XXXX   42. FD/SC Class:   XXXXXXXXX
33. Observed During: XXX   43. Chargeability: XXXXXXX
34. Action: XXXXXXXXXXXX   44. Incident Status: XXXXX
35. (NOT USED)             45. Corrective Action#:
                                    (RESERVED)
------------------------------------------------------------
46. Categories:  XXXXXX|XXXXXXXXXX|XXXXXXXX|XXXXXXXXXXX
47. Keywords:    XXXXXX|XXXXXXXXXX|XXXXXXXX|XXXXXXXXXXX
------------------------------------------------------------
 Test Environment:         Type:          Condition:
48. XXXXXXXXXXXX|XXXXXXXXXXXXXXXXXXXXXX|XXXXXXXXXXXXXXXX
49. Disposition: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

--------------- III  INCIDENT SUBJECT DATA -----------------
50. Name: XXXXXXXXXXXXX     60. FGC: XXXXXXXXXXXXXXXXX
51. Serial#: XXXXXXXXXX     61. LSA#: XXXXXXXXXXXXXXXX
52. FSN/NSN: XXXXXXXXXX         Part Life:  Units:
53. Mfr: XXXXXXXXXXXXXX     62. XXXXXXXXXXXXXXXXXXXXX
54. Mfr Part#: XXXXXXXX     63. XXXXXXXXXXXXXXXXXXXXX
55. Drawing#: XXXXXXXXX     64. XXXXXXXXXXXXXXXXXXXXX
56. Quantity: XXXXXXXXXX    65. Next Assy: XXXXXXXXXX
57. Action: XXXXXXXXXXXX    Serial#: XXXXXXXXXXXXXXXX
58. (NOT USED)              67. Software Version#: XXXXXX

------------------- IV  MAINTENANCE DATA--------------------
70. Diagnostic Clockhours: XXXX:XX  80. Type:XXXXXXXXXXXX
71.  Diagnostic Manhours:  XXXX:XX  81. Level Used: XXXXX
|71. Diagnostic Manhours:     XXXX:XX  |81. Level Used:
```

Figure 17-4. TIR Field Placements and Allowable Lengths.

```
72. Total Maint Clockhours: XXXX:XX  82. Level Prsc: XXXXX
73. Total Maint Manhours:  XXXX:XX   83. Level Recm: XXXXX

-----------V INCIDENT/MAINTENANCE DESCRIPTION----------------
90. XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
-------------------------------------------------------------
TIR Number:                                     Page Number:

 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
-------------------------------------------------------------
                 MAINTENANCE TIME BREAKDOWN

DateSt DateEd TmSt TmEd Level Delay  Type Dgchrs Tmchrs Dgmhrs
XXXX   XXXXXX XXX  XXXX XXXXX XXX:XX XXXX XXX:XX  XXX:XX XXX:XX

Tmchrs  App
XXX:XX   X
-------------------------------------------------------------
                   PARTS REPLACED DATA

Nomenclature FGC (Numbering control used) PartLife Level Qty
XXXXXXXXXX   XXXX  XXXXXXXXXXXXXXXXXXXX   XXXXXXXX XXXX  XXX

Action
XXXXX
-------------------------------------------------------------
Name, Title & Phone of Preparer:      FOR THE COMMANDER:

98. XXXXXXXXXXXXXXXXXX           99.XXXXXXXXXXXXXXXX
    XXXXXXXXXXXXXXXXXX              XXXXXXXXXXXXXXXX
    XXXXXXXXXXXXXXXXXX              XXXXXXXXXXXXXXXX
  -----------------------------------------------------------
-----------------VI  CORRECTIVE ACTION DATA -----------------
CA Status:      |  Asgd Resp:     |     CA review team date:
100. XXXXXXXXXX   101. XXXXXXXXXXXX      102. XXXXXXXXXXX
 ------------------------------------------------------------
120. Developer's Analysis of Problem:

XxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxX
-------------------------------------------------------------
121. Status/Description of Corrective Action:

XxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxX-
------------------------------------------------------------
122. Test Results on Corrective Action:

XxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxX
-------------------------------------------------------------
123. Planned Production Implementation:
XxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxXxX
```

Figure 17-4. TIR Field Placements and Allowable Lengths.

Figure 17-5. Test incident (TI) data stream.

(To Be Determined. The data stream is under development and should be available by 1st QTR FY 93.)

Figure 17-6. Corrective action (CA) data stream.

(To Be Determined. The data stream is under development and should be available by 1st QTR FY 93.)

Figure 17-7. Army test incident reporting system (ATIRS) access application form.

(To be provided in the next DA staffing.)

^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z
^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z^Z

Chapter 18
Other Test and Evaluation Considerations

18-1. General
The special considerations outlined in this chapter should be addressed during the T&E of systems throughout their life cycle. Applicability of the following considerations and scheduling for associated testing will be addressed by the TIWG members and included in the TEMP, TEP, TDP, IEP, TR, expanded TR, TER and IER.

18-2. Hazardous waste source reduction
Under the provisions of AR 200-1 and AR 200-2, consideration should be given in the early stages of the acquisition cycle to reducing the use of toxic or hazardous materials when new systems are tested.

18-3. Climatic testing

a. The Army recognizes four climatic design types: hot, basic, cold, and severe cold (AR 70-38). In general, all Army systems must operate in and are designed (as a minimum) for the basic climatic design type.

b. Environmental testing requirements for military hardware must be tailored to each specific system according to the environmental tailoring process described in MIL-STD 810 and AR 70-38. The objective of such tailoring is to ensure that military equipment is designed and tested for resistance to those environmental extremes that it will encounter during its life cycle.

c. Appropriate environmental chamber or laboratory tests will be scheduled early in the acquisition cycle to screen materials, components, or entire items for possible design materiel or reliability problems. Chamber or laboratory test procedures, such as those provided in MIL-STD 810 and MIL-STD 781, must be tailored to ensure that the tests procedures incorporate realistic environmental parameters and levels. For MIL-STD 781 type-reliability testing, chamber test conditions should also emulate field-use conditions (e.g., operational mode summary and mission profile, workload software, and duty cycle). Chamber testing may be used to investigate materials or component performance in conditions not expected to occur frequently under natural conditions. Requirements and timing for chamber and natural environmental testing will be documented in the T&E master plan.

d. Maximum use should be made of data from the developmental and operational testing field-test sources. The tester must ensure that field-test sites are selected to address environmental challenges at appropriate locations during stress-producing seasonal conditions.

e. Under the basic climatic design type conditions defined by AR 70-38 and MIL-STD 810 and as modified by the requirement document and the T&E master plan, climatic tests (chamber, laboratory, or actual field environment) will be completed before type-classification standard. Systems specifically designated for use in extreme climates will complete tests in the designated environments before type-classification standard. If the independent evaluators determine that chamber or laboratory testing is not adequate to address the issues, climatic tests that are critical to the basic acceptability of the system will be conducted during developmental and operational testing at natural field environmental test sites.

18-4. Environmental impact

a. For critical environmental concerns, testing is performed to identify and quantify the emissions, effluents, and wastes produced by the system. (See AR 200-2.) Specific subtests designed to measure emissions, effluents, and wastes may be prescribed in the T&E master plan and the TDP. These environmental quality characteristics and issues will be evaluated in the IER.

b. In addition, the program manager may request that the developmental tester conduct tests and measurements to support the life-cycle environmental documentation.

c. The program manager will prepare environmental documentation consistent with the requirements of AR 200-2 to address the environmental effects pertaining to the use and operation of Systems through the life cycle. The environmental documentation will be provided to the developmental and operational testers before testing commences at an Army or contractor facility or location.

18-5. Joint Test and Evaluation (JT&E)

a. The Office, Secretary of Defense (OSD) develops and administers testing programs requiring two or more services or other government agencies' participation in planning, conducting, or supporting OSD requirements.

b. The JT&E may be oriented toward development and acquisition, tactics, or doctrine but is usually not acquisition oriented. The ODCSOPS (DAMO-FDT) will publish the annual call for Army JT&E nominations. OSD-directed JT&E normally are initiated through nominations submitted to the OSD Senior Advisory Council (SAC). HQDA, TEMA and OPTEC screen and coordinate proposals for OSD-directed JT&E and consolidate and prioritize nominations for the ODCSOPS SAC member. The ODCSOPS reviews the JT&E nominations and presents a coordinated Army position on test proposals as a member of the SAC. OPTEC has management responsibility for JT&E programs. OPTEC is the resourcer (Army) for JT&E, which includes the feasibility study and chartered phases. Nominations/participants in JT&E must notify OPTEC and coordinate all resources early in the JT&E process, to ensure that requirements for personnel, funding, equipment and units are entered into the appropriate support cycle. The different support cycles are; Management of Change Window (MOC), Planning Programming Budget System (PPBS) and the TSARC. When the Army is the lead service for an OSD chartered JT&E, OPTEC provides the initial administrative assistance to the designated Joint Test Director (JTD). DODI 5000.2, Part 12, Section B and DOD 5000.3-M-4, JTE Procedures Manual, will be utilized for all JT&E. Additionally, a joint test and evaluation handbook (draft) is available for use pending publication by OSD.

18-6. Multiservice/Joint Test and Evaluation
Multiservice T&E is acquisition process testing. It is a type of JT&E conducted on a system being acquired by more than one DOD Component. Multiservice T&E planning, conduct, reporting, and evaluation shall include the participation and support of all TIWG members. The Lead Service will have overall responsibility for management of the MOT&E program and will ensure that Supporting Service requirements are included in formulation of the basic resource and planning documents. The Supporting Service will ensure that all of their requirements are made known, and will assist the Lead Service in execution of the T&E program. The lead service is responsible for preparing and coordinating a single TEMP, a single test plan, and a single test and evaluation report reflecting the system's technical performance and operational effectiveness and suitability for each service component. Coordination of the TEMP will be as depicted in Part II, this pamphlet. Multiservice T&E are normally initiated by a Joint Service Operational Requirement (JSOR) (See AR 71-9). Testing procedures for multiservice test and evaluation follow those of the lead service, with variance as required, resolved through mutual agreements.

18-7. Limited Procurement-Urgent (LPU) and Other Expedited

Acquisitions

a. LP type classification is used when a materiel item is required for special use for a limited time. The specified limited quantity for the LP item will be procured without intent of additional procurement of the item under this classification. The LPU type classification is used to meet URGENT operational requirements that cannot be satisfied by an item type classified Standard (STD).

b. Criteria for LPU type classification of an item required for urgent operational use will include the following.

(1) Existence of an urgent operational requirement, substantiated by the user representative and combat developer or by HQDA.

(2) Determination that there is no type classified item that fully satisfies the requirement.

(3) Sufficient definition of the military characteristics of the item in materiel requirements documents to allow subsequent evaluation of the item.

(4) Demonstration that the proposed item does not qualify for STD and offers no more than a moderate risk.

(5) Determination that the proposed item can be economically maintained and logistically supported in the geographic area and time frame for which the type classification is valid.

c. Type classification LPU will not be used solely to avoid test and evaluation of the item.

d. Not later than six months following delivery of the initial shipment of the LPU item, the user or requester of the item will collect data and provide an operational field evaluation statement to the program manager or mission assignee agency. Information copies will be provided to HQDA (SARD-RPP), TRADOC, AMSAA, OPTEC, and MRSA.

18-8. Acquisition of Nondevelopmental Items (NDI)
Nondevelopmental item acquisition is a generic term that covers systems or pieces of equipment which may require limited development effort by the Army. NDIs include materiel developed and in use by other U.S. military services or government agencies, materiel developed and in use by other countries, and

materiel available commercially. There are two general categories of NDI and a third level of effort not designated as a separate category (AR 70-1).

a. Basic NDI. Basic NDI consists of off-the-shelf items (e.g. commercial, foreign, other services) which will be used in the same environment for which they were designed and will require no modification.

b. NDI Adaption. NDI Adaption consists of off-the-shelf items to be used in an environment different than that for which designed and which will require modification to satisfy requirements.

c. NDI Integration. NDI Integration is focused on the integration of existing proven components. This category may require some hardware and software development and integration. MS I and MS II decisions occur very close together and the MS II decision point is waived based on a judgement that there is no need for development. NDI feasibility surfaces during the normal requirements generation process with the preparation of an Mission Need Statement (MNS) and a preliminary determination of whether NDI is a viable option. This determination by the MATDEV is based on an initial analysis of the operational requirements in the MNS versus technology or materiel already developed and in existence (e.g., foreign-made materiel). The criteria for a viable option is that a facsimile system or elements of a system are already operationally successful and are adaptable to the operational requirements specified in the MNS.

d. An important advantage of NDI alternatives is reduced acquisition time. This is accomplished, in part, by minimizing Army testing on NDI. General guidance is that we will not test when existing date (contractor or other sources) provides us reasonable answers. It is imperative that independent evaluators get involved early, participate in the NDI program, and provide operational assessments or test and evaluation reports.

e. Test and Evaluation. No acquisition, including NDI, is exempt from DT/OT&E necessary to verify the MANPRINT, quality, safety, reliability, performance, supportability, transportability, and availability characteristics of a system. Tests by manufacturers and contractors, previous performance data, and market analysis information may validate the acceptability of these characteristics and provide evidence of system operational effectiveness and suitability. However, for the production decision at least minimal OT&E is required. This must follow standard DOD policy with regard to system contractor

involvement.

f. Testing prior to initial milestone decision review. Testing should be limited to that absolutely necessary to obtain data necessary to make the NDI decision. This is accomplished through the Market Investigation (MI).

(1) As an initial step, the Army will minimize testing by:

(a) Obtaining and assessing contractor test results.

(b) Obtaining usage/failure data from other customers.

(c) Observing contractor testing.

(d) Obtaining test results from independent test organizations, e.g., Underwriter's Laboratory, National Bureau of Standards.

(2) Initial data collection. If, based on this initial data collection, it is decided that more information is needed to make a sound NDI decision, the MI may enter into an evaluation phase. NDI candidates may be bought or leased, and developmental and operational tests (including RAM and logistic support) should be conducted in the operational/combat environment. Safety procedures, in accordance with AR 385-16, must be followed prior to conducting operational or other user testing. The results will:

(a) Directly support the AS to accept or reject the NDI alternative.

(b) Influence preparation of requirements documents, such as, Operational Requirements Document (ORD), Training Device Requirement (TDR), Commercial Training Device Requirement (CTDR).

(c) Assist in preparation of solicitation documents.

(3) The test results will not be used to select a specific contractor or product.

g. Testing after the initial milestone decision review. All testing after the initial milestone decision review must be described and justified in the DCP and TEMP and specifically approved by the program decision authority.

(1) Developmental Test. No DT will be conducted unless U.S. Army Materiel Command (AMC) identifies specific information

needs that cannot be satisfied by contractor or other test data sources. The Army will not demand test data in rigid formats, but it will be flexible in accepting data that answers the essential questions. Risks associated with hardware/software modifications (NDI category B) and the third level of NDI effort involving integration of components will be carefully considered when determining test requirements.

(2) Operational Test. NDI does not automatically mean no EUTE, LUT, IOTE and FOTE will be required. If AMC demonstrates through the Market Investigation (MI) data that NDI products will satisfy the requirements document. OT will not be required with OPTEC and TEXCOM concurrence. This determination must be included in the initial milestone decision review documentation (DCP and TEMP) and approved by the program decision authority. For NDI category A, OT will not normally be required. For NDI category B, OT will be required only when critical issues in the TEP have not been addressed. A prior concurrence of the operational tester and evaluator is required to eliminate OT.

(3) Testing by NDI Category. Testing requirements will be tailored to each specific system. The following testing guidance by NDI category is not a rigid requirement, but rather general characteristics of testing activities appropriate to each NDI category. The goal of minimum testing still remains regardless of NDI category.

(a) Category A. No testing prior to Production Qualification Test (PQT) except when the contract awarded to a contractor who has not previously produced an acceptable finished product and the item is assessed as high risk. In that case, preproduction testing should be required.

(b) Category B. Feasibility testing is required in the military environment. Preproduction Qualification Test (PPQT) is required if feasibility testing results in fixes to the item. PQT is required. Limited operational evaluation may occur during feasibility and/or preproduction tests.

(c) Third level of NDI effort (Integration of Components). Feasibility testing is required in military environment. PPQT of complete system is required. Hardware and computer software integration tests required. Operational testing required. PQT required.

(4) Follow-On Evaluation. Testing of the NDI after the first unit is equipped is oriented to the validation and refinement of operating and support cost/data, RAM

characteristics, logistic support, training, provisioning planning, etc. These tests can materially aid the logisticians in supporting NDI throughout its life-cycle.

18-9. Materiel Change (MC) Test and Evaluation

a. Test and evaluation will be conducted on all materiel changes (for materiel systems) and Post Deployment Software Support (PDSS), Information Systems (ISs). The scope and type of T&E will vary for each MC/PDSS and will be documented in accordance with this pamphlet.

b. Test and evaluation of Materiel Change and Post Deployment Software (PDS) require both developmental and operational testing. The purpose of this testing is to determine the viability and adequacy of the change and to determine if the change was achieved without degradation to the system, other components, or interface equipment. MC involves reconfiguration of a fielded item to provide new or enhanced capability, extend the useful life of the system, improve safety or readiness, or reduce operation support cost. MC includes Product Improvement Programs (PIPs) which are not preplanned.

c. MC is normally necessitated because of a development (e.g, technological breakthrough, doctrinal change, revised threat estimate) has occurred after the original system configuration was fixed. Documentation and testing are reduced from new system development, as are milestone reviews, because both documents and decision issues are oriented upon the areas of change. The general rule for materiel improvement applies, that if the performance envelope changes significantly, then requirements documents are required, and the associated TEMP and OT&E cycles apply. However, if the materiel change is focused only on reduced operating costs, minimal operational testing is performed to ensure no degradation of overall system performance. The IOE must draw upon military expertise, materiel acquisition knowledge, and current Army policy to make a recommendation to the TIWG. The evaluator, in coordination with the ODCSOPS staff officer, informs DOTE of the materiel change if the system has been designated for DOTE oversight.

d. The following criteria will be used to determine the T&E conduct on MC/PDSS:

(1) Upon initiation of an MC or PDSS, the program manager will determine if formal coordination with the combat developer or functional proponent is required. When formal coordination is required and the CBTDEV or FP indicates that there are critical

operational issues associated with the MC or PDSS, the program manager will charter a TIWG. The TIWG will determine the type and amount of testing that is required to be performed on the MC/PDS. This testing will be documented in the TEMP. The level of program management will be categorized based on the same criteria used for new starts, and the decision authority or TEMP approval process will be consistent with the categorization. An OA or AOA will be prepared by the developmental evaluator or assessor, and a developmental evaluation or assessment report will be prepared to support the decision review for approval of procurement and application.

(2) When the formal coordination with the combat developer or functional proponent is not necessary, or when the combat developer or functional proponent indicates that there are no critical operational issues associated with the MC or PDSS, T&E will be conducted as appropriate, documented and included in the program manager's package provided at the decision review. A TIWG, a TEMP and an operational evaluation are not required in this case. However, the program manager will consult the MATDEV, Independent Developmental Evaluator or Assessor, to determine if coordination is required with the independent developmental evaluator or assessor. When coordination is required, an independent developmental evaluation or assessment will be performed unless waived by the independent developmental evaluator or assessor. Waiver of the requirement for an developmental evaluation or assessment may occur if the checksheet indicates that coordination is not required or if the developmental evaluator/assessor, after review of the package, determines that an evaluation or assessment is not needed. In this case, formal notification to the program manager will be made by the independent developmental evaluator/assessor.

e. When a block modification is being tested or when testing for more than one MC or type of PDS is actively being conducted on a system, and are planned to be integrated into the same end item, efforts will be integrated so that maximum T&E efficiencies are achieved. One TEMP (in those cases where a TEMP is required) shall be prepared integrating the T&E required into one comprehensive master plan. The TIWG members shall plan and conduct T&E so that maximum efficiencies in assessing specific aspects of the various MC/PDSS can be achieved. In cases where integration is not practical (e.g., different program manager agencies), every effort shall be made to assure that system integration testing of all MC/PDSS is performed.

18-10. Army Clothing and Individual Equipment.

Clothing and individual equipment (CIE) will be tested and evaluated in accordance with AR 700-86. CIE programs are initiated by an approved Statement of Need-Clothing and Individual Equipment (SN-CIE) (AR 700-86). CIE are subject to an Army Clothing and Equipment Board (ACEB) review, which constitutes the IPR for those items.

18-11. Test and Evaluation in Support of SOCOM
The nature of SOCOM's mission, their requirements for peculiar equipment and the expediency in which that equipment is needed raise several issues in test and evaluation support. SOCOM, TECOM and OPTEC must work together to conduct developmental and operational test and evaluation in accordance with the DOD 5000 series directives and AR 73-1 and still meet the requirements of SOCOM.

18-12. Training devices and ancillary equipment
Provisions of this regulation apply to the T&E of all ancillary equipment and components (for example, training devices, ground support equipment, and field maintenance test sets) (AR 350-38). For training devices, the developmental evaluator will also address the critical technical parameters, performance levels, proficiency, and effectiveness. The operational evaluator addresses training effectiveness and utility of system training devices.

18-13. Airworthiness
Aircraft systems, subsystems, and allied equipment will be tested and evaluated (AR 70-62).

18-14. Department of Defense hazard classification
All explosive systems and explosive components must be hazard-classified to legally transport and store them (MIL-STD 882). Classification actions frequently require testing. It is critical that sufficient items are scheduled for use in these tests and that the tests are completed before type classification.

18-15. Security
Information that is properly classified or that is determined to be unclassified but sensitive (for example, proprietary information and competition-sensitive information) must be safeguarded throughout the life cycle. A comprehensive protection and technology control program shall be established for each program to identify and protect this information (see DoDI 5000.2, Part, Section 5). Procedures for implementing this policy are contained in AR 380-5 and AR 530-1.

18-16. Communications security equipment

The National Security Agency is responsible for testing communications security equipment during the early stages of the life cycle. Testing performed by the National Security Agency on communications security equipment during these phases will fulfill the requirements of this regulation.

18-17. Range safety data

Army weapons, munitions, and lasers require the development of range devices, as well as safety data, to ensure safe and effective testing, peacetime training, target practice, and tactical employment (AR 385-62 and AR 385-63). These data must be available before operational testing with troops. It is critical that sufficient ammunition or explosive devices be scheduled for use in the development of these data (AR 385-16). (See AR 70-1.)

18-18. Volunteers as subjects of research

a. HUCs will be established and will function in accordance with AR 70-25 at USAOPTEC, USAMC, USAISC, and USASDC. As an alternative to establishing an in-house HUC, commanders may use the review process provided by TSG Human Subjects Research Review Board, as stated in AR 70-25. These HUCs will review appropriate DTPS, TDPS, or equivalent documents to determine the level of risk.

b. The HUC will recommend that the test plan-approving official either approve, approve with modifications, defer review to higher authority, disapprove, or exempt from further review.

c. If a HUC at USAOPTEC, USAMC, USAISC, or USASC determines that the level of risk is greater than minimal and that the test would thereby require the participants to be volunteers, the test plan or equivalent document will be forwarded to the T&E Management Agency so that HQDA can review it and submit a recommendation to the Secretary of the Army as to the approval or disapproval. The Secretary of the Army will be the decision authority in these cases.

d. Membership and administrative procedures for each HUC at USAOPTEC, USAMC, USAISC, or USASDC will be provided to (and will be maintained on file at) the T&E Management Agency.

e. After a HUC has determined the level of risk, AR 70-25 allows the HUC to recommend exemption from further human use

review. After a HUC at USAOPTEC, USAMC, USAISC, or USASDC has made such a recommendation, further review of the system or equipment will not be required unless the program manager, the developmental or the operational tester determines that changes in the system or equipment, test planning, or the method of employment warrant such further review.

f. If a HUC recommends an exemption from further human use review, the program manager will include that determination in part II of the T&E master plan for the system and equipment.

g. The HUC should determine the level of risk based on its review of the system and equipment in the context of the planned testing (based on the test planning documentation), the safety release, the doctrine, tactics, method of employment, and the test methods to be followed.

h. The HUC will ensure that functional expertise on the system and equipment and the location and type of testing are obtained, where appropriate, to assist it in determining the risk.

Chapter 19
Instrumentation, Targets, and Threat Simulators (ITTS)

Section I
Introduction to ITTS

19-1. Purpose
This chapter provides a guide for effective and efficient planning for instrumentation, targets, and threat simulators (ITTS) to stress Army systems during materiel test and evaluation (T&E) and Force Development Test and Experimentation (FDTE) and to capture the appropriate performance information/data for analysis and reporting.

19-2. Scope
This chapter outlines the roles, responsibilities, and relationships of key activities involved in planning for, managing, and using ITTS in support of T&E and FDTE. Describes planning factors and considerations to facilitate efficient and effective use of ITTS. It also Identifies key inventory and capability accounting systems and describes procedures for asset scheduling and use and provides formats and instructions for preparation and processing of required documentation.

19-3. Background
In 1989, Defense Management Review (DMR) Decision 936 and the parallel Army Management Review (AMR) focused on increasing management and operational efficiencies. It was determined that substantial costs could be saved by consolidating operational T&E capabilities under a single command (Operational Test and Evaluation Command [OPTEC]), and centralizing funding and development/ acquisition management of targets, threat simulators, and major instrumentation under an Army Materiel Command (AMC) chartered Project Manager (PM). Thus, in October 1991, the Army officially established the Office of the Project Manager for Instrumentation, Targets and Threat Simulators (PM ITTS). Sustaining instrumentation remained the responsibility of the user (i.e., operational or developmental tester) under the oversight of the PM ITTS. In July 1992, PM ITTS was officially absorbed under the Simulation, Training, and Instrumentation Command (STRICOM) which is a newly established AMC Major Subordinate Command (MSC). The mission and functions of PM ITTS will essentially remain unchanged.

19-4. Definitions
Definitions of key terms are presented below. Additional

definitions are found in the Glossary to this pamphlet.

a. Instrumentation. Instrumentation is defined as electromagnetic (e.g., electrical, electronic, laser, radar, photosensitive, etc.) and other equipment (e.g., optical, electro-optical, audio, mechanical, automated information, etc.) used to detect, measure, record, telemeter, process, or analyze physical parameters or quantities encountered in the test and evaluation process. Instrumentation may apply to a system under test or to a target or threat simulator.

(1) Major Instrumentation. "Major instrumentation" is defined as that instrumentation which satisfies joint service requirements, serves multiple Army commands, requires a significant level of development and integration, or has a large dollar value (i.e., normally an acquisition cost of at least $1 million per year or a total cost of $5 million or more). Major Army instrumentation acquisition is normally Project Manager (PM) managed.

(2) Sustaining Instrumentation. "Sustaining instrumentation" is defined as that instrumentation which is not defined as major and which satisfies, within a single command, routine or recurring needs and normally has a lower acquisition cost than major instrumentation. Sustaining instrumentation is normally acquired by the requiring command.

b. Targets. Targets are normally economical, expendable devices used for tracking and/or engagement by missiles/munitions in support of T&E as well as training missions. Drone targets are air or ground vehicles converted to remote or programmable control. Ground targets are intended to represent an adversary ground vehicle system or ground based military structure. Aerial targets are intended to represent adversary aircraft. Targets may represent only selected adversary system characteristics.

c. Threat Simulator. Threat simulator is a generic term used to describe equipment which represents adversary systems. A threat simulator has one or more characteristics which, when detected by human senses or man-made sensors, provide the appearance of an actual adversary system with a prescribed degree of fidelity. Threat simulators are not normally expendable.

19-5. Roles

Many of the roles and organizational relationships depicted in Figure 19-1 and outlined below can be found in the responsibilities sections of other regulatory documents. However, some of the roles of key Department of Defense (DoD),

Headquarters, Department of the Army (HQDA), and Army components are repeated here to provide the reader with a condensed list for easier reference. Personnel who plan for and execute T&E responsibilities need to be aware that the roles listed below are directly or indirectly related to the planning for and acquisition and/or use of ITTS to support T&E.

(Insert Figure 19-1. The ITTS Community)

a. The Department of Defense (DoD) provides policy guidance and program direction; exercises Major Range and Test Facility Base (MRTFB) oversight; reviews program plans; allocates/defends program funding.

b. The Defense Test and Evaluation Steering Group (DTESG), chaired by the Director, Office of the Under Secretary of Defense (Acquisition) (OUSD[A]), has the responsibility of resolving resourcing issues, developing recommendations on policy, and highlighting significant issues in the areas of developmental T&E, operational T&E, and test facilities.

c. The Defense Intelligence Agency (DIA) and the Intelligence and Security Command (INSCOM) provide the intelligence base for the threat simulator and targets programs and exercise control over all intelligence production and analysis.

d. The Tri-Service Executive Committee (EXCOM), supported by the CROSSBOW-S Committee, sets policy, provides guidance, and exercises management oversight of the Tri-Service threat simulator program. The EXCOM approves: resources for the Five Year Defense Plan (FYDP), Integrated Technical Evaluation and Analysis of Multiple Sources (ITEAMS) validation reports at Design Specification Reviews (DSR) and Initial Operational Capability (IOC), the Army Five Year Threat Simulator Program, and the lead service for threat simulator development.

e. The Multi-Service Test Investment Review Committee (MSTIRC) is a Tri-Service activity subordinate to the Joint Commanders Group on T&E (JCG[T&E]), a sub organization of the Joint Logistics Commanders (JLC). The MSTIRC is chartered to review the Services' planned test investments for duplication, interoperability, commonality, potential joint development, and suitability as candidates for OSD central funding. The MSTIRC also recommends lead service assignments for joint developments and candidates for OSD Central T&E Investment Program (CTEIP) funding. Currently, the MSTIRC is undergoing major changes. While still unofficial, the MSTIRC will most likely be phased out and be replaced by the T&E Reliance Implementation Board (TERIB).

The TERIB will retain the functions of the MSTIRC and also include oversight of Reliance agreements.

f. The Operational Test and Evaluation Coordination Committee (OTECC) is a multiservice organization chartered by the DOT&E as the management and oversight body for the Resource Enhancement Program (REP). Its purpose is to offset shortfalls in high priority, short term (less than 3 years) operational test investment requirements which have multi-service application and enhance realism of service operational test and evaluation. The OTECC also coordinates, plans, programs, and budgets operational test investment requirements, tracks available OT&E assets, and coordinates service OT&E requirements for acquisition of foreign materiel to support operational testing.

g. The U.S. Army Test and Evaluation Management Agency (TEMA), under the operational control of the Deputy Under Secretary of the Army for Operations Research (DUSA[OR]), develops and monitors Army major range and test facility funding policy and coordinates T&E policy, resources and programmatics within the Department of the Army (DA) and with DoD. TEMA also charters and designates the chairman of Validation Working Groups (VWG) for targets and threat simulators.

h. The Army Test and Evaluation Committee (ATEC) provides a forum by which all elements of the Army T&E community, acting as a committee of the whole, formulate recommendations to the Army senior leadership regarding T&E policy, procedures, organizations, and resources.

i. The Army Instrumentation, Targets and Threat Simulators General Officer Steering Council (GOSC) exercises program management oversight and validates requirements, priority listings, and resource allocations for ITTS development and/or acquisition. The ITTS GOSC also recommends funding related program changes to OSD and approves major instrumentation system designations.

j. The DA General Officer Test Schedule and Review Committee (GO TSARC) reviews the Five Year Test Program (FYTP) to identify and coordinate ITTS requirements in support of scheduled testing.

k. HQ DA, Deputy Chief of Staff for Operations and Plans (DCSOPS) chairs the HQDA ITTS GOSC, and, in conjunction with TEMA, coordinates the ITTS programs within DA and prepares and defends Program Objective Memorandum (POM) submissions. DA DCSOPS also approves the Five Year Test Program (FYTP).

l. HQ DA, Deputy Chief of Staff for Intelligence (DCSINT) designates Threat Integration Staff Officers (TISO) for Acquisition Category (ACAT) I, II, and OSD Oversight systems to assist developers and the T&E community in generating and articulating requirements for timely, consistent, and continuous threat support for developmental systems. The DCSINT provides developers and testers with validated intelligence data on threat system capabilities, characteristics, tactics, and doctrine. The DCSINT approves the Integrated Threat Tactical Operations Plan (ITTOP). The DCSINT also functions as the Army executing agent for the Foreign Military Exploitation (FME) and Foreign Military Acquisition (FMA) programs and provides an executive member for the HQDA ITTS GOSC.

m. The U.S. Army Materiel Command (AMC) performs the duties of materiel developer of assigned systems required by the Army. AMC also provides an executive member for the HQDA ITTS GOSC.

n. The U.S. Army Simulation, Training and Instrumentation Command (STRICOM) is a newly established AMC MSC. STRICOM is charged with providing centralized management and direction for the RD&A of Army Training Devices, Simulators and Simulations (TDSS), major instrumentation, targets and threat simulators, and the Distributed Interactive Simulation (DIS). STRICOM will resolve issues concerning ITTS which evolve from disagreements between PM ITTS and other AMC elements such as AMC PMs and Major Subordinate Commands (MSC).

o. The Project Manager (PM) ITTS is the Army's single manager for the research, development, and acquisition of targets, threat simulators, and major instrumentation. PM ITTS manages: the Army portion of the CTEIP and the Resource Enhancement Program (REP); planning, programming, budgeting, justifying, and defending mission related funding; development and/or acquisition, fielding, and modernization of major instrumentation systems, targets, and threat simulators; and inventory/capability accounting (i.e., Test Facilities [TESTFACS] Register). The Threat Simulator Management Office (TSMO) and the Targets Management Office (TMO) as a part of PM ITTS, serve as materiel developers for assigned systems. Work with users of ITTS on the identification and definitization of requirements documents.

p. The U.S. Army Operational Test and Evaluation Command (OPTEC) chairs the General Officer (G.O.) Test Schedule and Review Committee (TSARC); formulates, prioritizes and executes the User Test Instrumentation Program (UTIP) in support of operational testing; identifies and documents major instrumentation, targets and threat simulators requirements for

development and/or acquisition by PM ITTS; functions as the combat developer (CBTDEV) for operational T&E threat related systems; and provides an executive member for the HQDA ITTS GOSC. Additionally, the OPTEC Threat Support Activity (OTSA) has responsibility for operation and maintenance of high fidelity Army Threat Simulator assets and publication of the ITTOP.

q. The U.S. Army Test and Evaluation Command (TECOM) formulates, prioritizes and executes the Test Technology Development and Acquisition Program (TDAP) in support of developmental testing; identifies major instrumentation, target, and threat simulator requirements for development and/or acquisition by PM ITTS; functions as the CBTDEV for developmental T&E threat related systems; identifies and manages research and development of non-major/sustaining instrumentation programs; stores, maintains, and conducts signature measurement for target and threat simulator validation; and provides an executive member for the HQDA ITTS GOSC.

r. The Defense Intelligence Agency (DIA) Missile and Space Intelligence Center (MSIC) and the U.S. Army Missile Command (MICOM) provide matrix support to PM ITTS for development and acquisition of Army targets and threat simulators.

s. Testers identify their respective test instrumentation, targets, and threat simulator requirements, document and submit new/revised requirements for incorporation into their respective command level programs, operate and maintain assigned instrumentation and target assets, and provide input to TESTFACS.

t. U.S. Army Training and Doctrine Command (TRADOC), U.S. Army Forces Command (FORSCOM), and other Major Army Commands (MACOM) identify requirements and manage assigned assets. TRADOC also provides an executive member for the HQDA ITTS GOSC.

u. Program Executive Officers (PEO) and Program/Project Managers (PM) formulate and coordinate Test and Evaluation Master Plans (TEMP) for their respective systems and identify (and fund, if necessary) system unique instrumentation, target, and threat simulator requirements. They provide to PM ITTS all ITTS requirements for government testing which cannot be accommodated by existing resources.

v. Test Integration Working Groups (TIWG), chaired by the materiel developer, coordinate and integrate T&E planning and participation of all members of the acquisition team. TIWGs facilitate use of appropriate test expertise, instrumentation, targets, threat simulators, facilities, simulations, and models;

integrate test requirements; accelerate the TEMP coordination process; coordinate threat support; resolve cost and schedule problems; and provide a forum to ensure that test and evaluation planning, execution, and reporting are coordinated.

Section II
ITTS Planning

19-6. General
Planning for instrumentation, targets, and threat simulators to support test and evaluation must begin early in the T&E planning cycle to ensure timely and adequate support. The planning is iterative, beginning with general requirements, evolving into specific requirements, and culminating with scheduling or recommendations for purchase or design, as appropriate. ITTS planning is based on combat developer derived Critical Operational Issues and Criteria (COIC) which focus and support milestone decisions for U.S. system acquisitions. COIC prescribe and provide a consistent emphasis on the user's minimum essential effectiveness and suitability expectations from the total system at the milestone decision for full production. COIC are discussed in detail in Part Three.

19-7. Acquisition Program Management Documents
During the acquisition of Army materiel systems, various documents are required which are either indirectly or directly related to the planning of ITTS support. They in turn are related as graphically depicted in Figure 19-2. Documents which do not specifically address ITTS but discuss the threat related to a particular materiel system are discussed below.

(INSERT FIGURE 19-2 HERE)

a. Operational Requirements Document (ORD). The ORD is used as a basis for baselining and to develop requirements for contract specifications. The ORD contains a brief threat assessment statement that describes key threat elements related to the mission deficiency being documented.

b. Integrated Program Summary (IPS). The IPS is generated by the Materiel Developer (MATDEV), in coordination with the CBTDEV, and contains an assessment (derived from the System Threat Assessment Report [STAR]) which describes the DIA validated threat with emphasis on interactive effects of the acquisition and the threat.

c. Cost and Operational Effectiveness Analysis (COEA). Threat in support of the COEA is based on an updated System Threat Support Plan (STSP), the STAR, and other baseline intelligence products. Threat support from outside TRADOC is coordinated by the Threat Coordinating Group (TCG). Additionally, the Threat Manager (TM) maintains an accurate audit trail of all threat used (particularly that developed and approved specifically for the analysis). The COEA report contains a summary of threat provided in support of the process. Addressed are the full range of threat and conditions under which tasks must be performed throughout the life cycle of the system, beginning at IOC. It also provides quantifiable near-, mid-, and far-term system threat Scientific and Technical Intelligence (S&TI), and operational art, employment, and deployment data.

d. Test and Evaluation Master Plan (TEMP). The TEMP documents basic planning for all life cycle T&E related to a particular system acquisition (See Part Two). The TEMP contains an enumeration of new instrumentation requirements in Part V, T&E Resource Summary. Part V also contains a brief description of the post-IOC threat and identifies by type, number, availability, and required fidelity, all targets, threat systems, and/or threat simulators required to support testing. Any major shortfalls are highlighted.

e. Test and Evaluation Plan (TEP). The TEP is a coordinated, single operational T&E planning document which combines two formerly distinct and separately developed plans, the IEP and the TDP (See Part Five). The TEP defines the approved post-IOC threat, including capabilities, typical means of operation, and known means of defeating the U.S. system under test. For MS I/II, it contains a statement of potential targets, countermeasures, and opposing weapons that a single system can expect to encounter on the battlefield. For post MS I/II, the statement describes the threat to the next higher level system in which the tested system is embedded.

f. Outline Test Plan (OTP) (See AR 15-38). The OTP identifies ITTS, quantities, and associated costs necessary to realistically simulate the operational environment, consistent with test objectives. The OTP is prepared and maintained by the designated tester.

g. Threat Test Support Package (Threat TSP) (See Chapter 9). A Threat TSP is prepared for each operational test. It is based on the STAR and is shaped by requirements derived from the TEMP, TEP, and OTP. Threat TSP format is contained in AR 381-11, Appendix B. The Threat TSP includes the STAR, as an appendix,

and other tailored, test specific appendices which address test threat scenarios, limitations (how the threat to be portrayed differs from that of the scenario), a weapon and target matrix, and Opposing Force (OPFOR) training plan for force-on-force testing, and a detailed tactical operations plan for threat simulator support, derived from the ITTOP. Additionally, the Threat TSP will include information related to the technical characteristics and limitations of the threat simulators/targets/surrogates derived from accreditation reports.

h. Target/Threat Simulator Accreditation Report. An accreditation report serves to document whether an individual target or threat simulator is suitable to represent a required threat system for a specific test. The report defines differences which cannot be accommodated or offset in test planning and assesses their impact. The accreditation report is prepared by the Threat Accreditation Working Group (TAWG). Its completion is required sufficiently in advance of testing to influence planning.

i. Test Report (TR). A TR serves as the primary record of a test. It presents factors and conditions under which the test was conducted, documents the resulting data base, and presents the data (quantitative and qualitative) resulting from the test. The tester will document deviations between planned and actual threat representations by targets and threat simulators during the test for consideration by the Data Analysis Group (DAG) and independent evaluator. The test report is prepared and approved by the tester, following DAG authentication of data base validity (See Parts Four, Five, and Six).

j. Independent Evaluation and Assessment Reports. The Independent Evaluation Report and Independent Assessment Report document the analysis and evaluation resulting from all previous testing, analyses, studies, modeling, and observations in support of a milestone decision review. It presents conclusions, major findings, analysis and supporting rationale for the conclusions, a position on the future capability of the system to fulfill the approved requirements in the areas of operational effectiveness (to include survivability) and operational suitability, and the program constraints and resulting impacts on the evaluation. Threat related analysis, conclusions, and findings play a major role in quantifying operational effectiveness. The projected post-IOC threat is documented in the reports.

Section III
Instrumentation Support

19-8. Support Planning
Test plans and data collection methods are discussed in Parts Four, Five, and Six. For ITTS support planning, inventory and capability accounting sources should be used to identify availability of specific instruments and types of instruments necessary to capture the required data. Because various instruments have different performance characteristics, support requirements, and availability, this information, when integrated with test schedule requirements and data accuracy requirements, will frequently drive how a test must be structured.

19-9. Instrumentation Support Plan
For tests not covered by TOPs or other published Standard Operating Procedures (SOP), instrument support planning may be articulated by the tester and/or instrumenter in an informal Instrumentation Support Plan (ISP). For major tests with widely diverse efforts, a separate ISP may be prepared for each major category of testing (e.g., fire control evaluation, automotive performance, force-on- force) The potential content of the ISP is discussed in the following subparagraphs.

a. Support Concept.

(1) Purpose. This section defines the test effort supported, who will use the plan, and how it is to be used.

(2) Scope. This section defines the scope of the ISP. It should bind the instrumentation effort to a specific set of tests or subtests, as well as identify what aspects of the instrumentation effort are discussed or omitted.

(3) Approach. This section describes the overall approach to test execution. It should describe the type of test to be conducted, the execution scenario, the classes of data to be collected, a general description of the instrumentation to be used, and the relationship between the instrumentation and operational aspects (normally, engineering tests adjust to the limitations and constraints of the instrumentation, while instrumentation must be transparent to the test players in operational testing).

(4) System Description. This section describes, in broad terms, how the instrumentation interfaces to the system under-going test. To ensure clarity, both the test item and the instrumentation should be described. The instrumentation description should address each system or device mounted on or attached to the system under test, as well as instrumentation

remote from the system under test. All modifications/alterations to the system under test, interfaces to the system under test, and development of modified and/or new instrumentation must be described in operational terms.

b. Data Collection.

(1) Data Requirements. The ISP specifies data requirements as described in the TEP or TDP. Using this information, the plan should describe the instrumentation source of each data requirement. All data must support the evaluation of an issue in the analysis plan.

(2) Collection Considerations.

(a) Accuracy. The desired and acceptable data accuracies should be indicated when ever possible. Both are necessary pieces of information because desired accuracy may not be achievable under all conditions. In some cases the interaction of instruments, weather, geography, satellite constellations, and other factors can cause data accuracies to change during the conduct of a test. Without this information, the instrumenters will be unable to design data collection configurations that will ensure all data is within usable parameters.
Further, they will not be able to monitor instrument performance during testing to ensure the entire exercise was conducted within acceptable bounds.

(b) Criticality. The criticality of each data element is important in establishing proper instrumentation support. In some cases every data requirement is critical because the test event may be non-repeatable, such as the firing of a prototype projectile or missile. These more critical data requirements must be provided greater assurance of capture. This is frequently accomplished by redundant collection systems or highly controlled test execution. In the operational testing environment, a trade off may be required between operational realism and data collection. In these decisions, data criticality is often the overriding factor.

c. Interface with Automatic Data Processing (ADP). The Instrumentation Support Plan requires close and continuous coordination with the Data Management and ADP portions of the DTP to ensure compatibility. This section includes plans to provide appropriate interfaces between the instrumentation system(s) and the ADP system(s) which will aid in the streamlined transfer of data from the instrumentation equipment to the ADP systems (files

or data bases). These procedures should specify the techniques, protocols, and formats for accomplishing the transfer of data and plans for verifying that complete transfer has occurred.

d. Instrumentation Requirements. The instrumentation requirements for a given test or subtest should be articulated in this section. It must be developed by the tester in conjunction with the instrumentation section organic to his organization.

(1) Hardware. This section should list the specific instruments or instrumentation systems that must be scheduled, borrowed, or procured to support the test or subtest. Where multiple systems can accomplish the same data collection task, they should all be listed and identified as suitable alternatives. Common instruments (typically in plentiful supply and common to most test activities) need not be listed. However, unusual quantities of common or expendable items should be included. Nonexistent instrumentation listed as a statement of requirement should also be included in the requiring activity's program for development and acquisition.

(2) Software. Test specific software such as scenarios for simulators, stimulators, and test specific instrument control should be identified. Some complex instrumentation may involve software which must be developed. This software usually requires long lead time for development, is costly, and must be validated well before the commencement of testing to ensure data elements are collected as required and extraneous data are not added. The Instrumentation Support Plan should address these considerations and should alert test planners to the lead time and costs involved.

(3) Personnel. Identify all special skills required to support the data collection effort. This should include uniquely trained instrumentation operators and technicians, as well as interviewers and medical personnel when subjective data or human use protocols are involved in the data collection effort.

e. Other Support Requirements. This is the section that addresses the logistic aspects of the instrumentation support.

(1) Security. A security plan for instrumentation must be developed to ensure adequate physical and communications security is provided for collected data. While the security plan is not a part of this document, the need and the instrumentation interfaces should be identified. Likewise, all collection, storage, and transport of classified data must conform to security regulations (e.g., AR 380-19) and red/black engineering criteria.

(2) Mobility. Instrumentation mobility requirements must be fully articulated. Both intra- and inter-range requirements must be addressed, to include method of movement and time required to accomplish the task. Additionally, specific transportation requirements, such as prime movers, special trailers, and unique materiel handling equipment, must be articulated.

(3) Facilities. While most tests are conducted on facilitized ranges with adequate power, telecommunications, access, shelter, and support facilities, some tests require facilitization for accomplishment. Specific range facilities for the installation, operation, and support of the test instrumentation should be articulated in this section.

(4) Support Services. Special support such as unique calibration requirements, installation and maintenance tools, and contract services, should be fully articulated in this section.

f. Test Support. This section describes methods for implementing the instrumentation planning during the phases leading up to a test. As a minimum, it should include milestones, demonstrations, training, pilot test, and test readiness reviews.

(1) Milestones. The Instrumentation Support Plan test support section should state specific milestones for instrumentation (e.g., target date to investigate types of equipment, target date to acquire instrumentation, target date to install equipment, and target date to train personnel to use the equipment).

(2) Demonstrations. Demonstrations of instrumentation should be conducted within the framework of the larger Test Planning Milestone Schedule. The target dates, extent, and number of demonstrations will vary from system to system; however, some general guidelines are helpful. A demonstration should probably precede each test readiness review. Also, if a new piece of instrumentation is introduced relatively late in the pre-test schedule, and after all other instrumentation has been demonstrated, it should not be overlooked. A date should be set to demonstrate this new piece. Finally, a request by one of the users (e.g., data manager, test director, evaluator) to see some piece of instrumentation demonstrated again should be granted if at all possible. In other words, demonstrations should be performed at planned dates as well as any additional times deemed necessary prior to the test. In early test planning stages, instrumentation may be demonstrated by itself; however, at some

time before the Pilot Test, the instrumentation must be demonstrated on or in conjunction with the system to be tested.

(3) Training. Specific dates should be scheduled for training personnel in the operations of instrumentation. The amount of training will vary according to the complexity and amount of instrumentation, but most of the training sessions should take place before the last demonstration and last test readiness review.

(4) Pilot Test. By the date of the Pilot Test, as scheduled in the DTP, instrumentation should be in full operation with fully trained personnel. For the Pilot Test, the instrumentation should be in place, operated as if running the actual test, and should generate real data for examination.

(5) Test Readiness Reviews (TRR). Test readiness reviews are discussed in detail in Parts Four and Five. This section highlights only those instrumentation issues which should be addressed during the TRR process.

(a) Initial. At the first review (approximately 270 days in advance of test), a preliminary and general review of instrumentation requirements and availability will be conducted. The review should include a tentative schedule of instrumentation availability/readiness milestones and should outline the types and extent of instrumentation capability required to support the test. If instrumentation is being built to satisfy test needs, a status report of development progress will be reviewed.

(b) Intermediate. At the second review (approximately 60 to 90 days in advance of test), the instrumentation schedule will be updated and the instrumentation concept laid out in detail, including additions and deletions to the preliminary plan. Further, any noticeable problems with any particular instrumentation will be addressed. Resulting from this review will be a decision concerning the requirement for and timing of training of test instrumenters.

(c) Final. At the third (final) review (occurs just after the Pilot Test), the status of instrumentation readiness will be assessed based upon the accuracy/adequacy of data collected during the Pilot Test (or earlier demonstrations or trials). The purpose of the assessment will be to isolate problems and/or deficiencies remaining in the ISP and to analyze their impact on test readiness. The assessment of how well each instrumentation system works in conjunction with the other instruments and how well each instrumentation system interfaces

with applicable ADP systems must also be reviewed. If problems are surfaced in these areas, corrective actions and their potential impact on test start should be highlighted. Another result of this review will be a decision as to whether instrumenters have been adequately trained to instrument the test and are aware of and trained in contingency plans for problems that may occur during the test.

g. Conduct of Test. During the actual conduct of the test, the major emphasis for instrumentation is on properly executing the support plan and on ensuring the data collected through instrumentation flow smoothly into the data management system. Accordingly, knowledgeable instrumenters should be present at the test site to expeditiously correct any problems whenever instrumented data is critical to the overall data collection procedure.

19-10. Needs Satisfaction

Direct test support instrumentation needs will normally be satisfied from assets on-hand within the test directorate or activity assigned responsibility for the test. Satisfaction of needs in excess of organic capability will make use of one or more of the following methods, listed in order of preference.

a. Borrow. Testers are encouraged to survey and query existing inventory data bases (e.g., OPTEC Instrumentation Data Base [OIDB] and Test Facilities [TESTFACS] Register), catalogs, etc., to determine what additional needed resources are in inventory, where, and in what quantities. Direct coordination with documented points of contact (POC) is also encouraged for the tester to gain a complete understanding of an item's capabilities, limitations, support requirements, suitability, etc., and to determine its potential availability. Schedule and use requirements are discussed later in this pamphlet; however, it should be noted here that the borrowing of instrumentation will normally be affected through Property Book Officer (PBO) channels (for accountability) and that the borrower will, in all probability, incur some fiscal liability (e.g., round-trip transportation costs). Additionally, the tester should be aware that borrowed instrumentation must be returned in its original configuration, unless otherwise coordinated in advance with the lender.

b. Lease. Standard off-the-shelf instrumentation (e.g., visicorders, oscilloscopes, digital voltmeters, signal generators, and others normally falling within the sustainment instrumentation category) may be leased or rented to satisfy short term inventory augmentation or one-time needs. However,

total lease/rental costs which could be incurred, to include any additional costs/penalties in the event of extension(s) necessitated by a test slippage, should be realistically compared to Non-Development Item (NDI) procurement costs before this option is pursued.

c. Modification/NDI Procurement. Testers will determine the extent of modification to an on-hand inventory asset needed to satisfy their requirement. A trade-off analysis of modification versus procurement of NDI (assuming availability) should be conducted to determine the most cost efficient approach. Normally, NDI will be the option of choice if it is more responsive/timely and procurement costs are less than 25% more than those for modification of an on-hand asset.

d. Full Scale Development. Design, development, and procurement of instrumentation for direct test support will be the exception due to the time required (experience has shown that the acquisition cycle for sustaining instrumentation can easily take 3-5 years and 8-12 years is not uncommon for a major instrumentation system). When full scale development of instrumentation is necessitated, the impact must be closely coordinated through the TIWG and the TSARC, documented first in ORD format, by the Requirer, for processing as prescribed in Section 9.4, and second in the TEMP, by the TIWG, as a potential test limitation.

Section IV
Target/Threat Simulator Support

19-11. General
Army systems are developed to defeat existing and potential threats. There is therefore a need to test against realistic targets and simulators of those threats. The development and use of targets and threat simulators is, accordingly, an integral part of the Army materiel acquisition process and necessitates planning sufficiently in advance to ensure availability when required.

a. Development Planning. Development planning makes use of a long range (10-15 year) focus geared to progressing from definition of generic threat technological advancements (e.g., directed energy) which have potential impact on current and/or future U.S. systems, to specific applications of technology (e.g., directed energy weapons) which directly threaten or are to be countered by U.S. systems. This planning makes use of an interactive, relational data base (Long Range Planning System

[LRPS] Army Site Configuration [ASC]), which draws initially from the Army Science and Technology Master Plan (STMP), TRADOC's Concept Based Requirements System (CBRS), National and DoD intelligence community products, and system acquisition documentation to establish system links (threat to and/or target of). Planning then evolves into focusing S&TI Centers and other intelligence organizations on specific systems through initiation of Intelligence Production Requirements (IPR) and/or through the use of ITEAMS as necessary. Candidate systems for development are identified by and/or to potential users (combat developers, PEO/PM offices, evaluators, and testers) for consideration through direct coordination, TIWG interface, and annual requirements conferences chaired by PM ITTS. Those candidates for which specific needs can be justified are subsequently documented in ORD format. TECOM functions as the combat developer for developmental test and evaluation threat related systems. OPTEC functions similarly for operational test and evaluation systems.

b. Use Planning. Use planning for targets and threat simulators in support of T&E is a cooperative effort between the intelligence, evaluation, research and development (R&D), and testing communities: intelligence officers identify and describe the system specific threat in all its aspects; evaluators determine which threat sensitive issues must be addressed by test; developers manage the development and acquisition of threat representative assets; and testers schedule and control threat representative assets in accordance with intelligence descriptions and estimates. For a myriad of reasons, not the least of which are system priority instability and available funding, use planning normally has a short range (1-3 years) focus and therefore normally results in reliance on existing targets and threat simulators for need satisfaction. This reality underscores the critical importance of long range planning as discussed above.

19-12. Related Documents

When planning for the use of appropriate targets and threat simulators, it is important to know how information on the threat to a U.S. system is derived and where the information is documented. While these documents support and justify the development of materiel systems, they are also used to identify targets and threat simulators required for T&E of the system. Some of the key threat information/documents used are described below:

a. Baseline Intelligence Products. Provides threat information by geographic region/country on all weapons systems,

doctrine, tactics, organizations, equipment, and military forces. It is continuously updated by DIA and approved by DIA.

b. System Threat Assessment Report (STAR) (See Chapter 13).

c. Integrated Threat Tactical Operations Plan (ITTOP). Provides information on all known and projected threat force mixes. It is used for threat simulators in inventory, provides command and control; integrated force operations; and crew drill and procedures (including ECM/ECCM). It is updated as required by OTSA with input from S&TI Centers. It is approved by DA DCSINT (crew drills/procedures validated by the MATDEV).

19-13. Support Planning

a. The Challenge. T&E is based on Critical Operational Issues and Criteria developed early in the acquisition process. Answers to many of these issues/criteria are threat sensitive in that they depend largely on the threat environment to which the system will be subjected. Some of the challenges to T&E planners are:

(1) Differences. Since development of Critical Operational Issues and Criteria precedes the development of the detailed threat assessments in threat related documents, significant differences can occur between the documented threat and that used to develop Critical Operational Issues and Criteria.

(2) Gaps. Intelligence gaps become evident when a system is progressively defined as it proceeds through the acquisition process. These gaps generate both intelligence production and collection requirements, which, as they are developed, may change the projected threat.

(3) System Operating Requirements. Due to the evolving threat, keeping the system operating requirements in consonance with the threat is sometimes difficult. However, failure to do so can result in an unrealistic T&E threat representation.

(4) Inaccuracies. TEMP and OTP development precedes that of the Threat TSP and can result in inaccuracies and/or inadequacies in projections of assets required for test threat representation.

b. Critical Intelligence Parameters (CIP). Together, the MATDEV and the intelligence community establish limits on how much the threat can change without causing a major redesign or reassessment of the program. These limits, expressed as CIPs, define thresholds for characteristics of actual or projected

threat systems (e.g., capabilities, numbers, types, or mixes of systems), which if exceeded, could substantially change a system's operational requirement. Once defined, CIPs are submitted through intelligence channels for validation and subsequent collection and production. They are included in the STAR and Threat TSP and serve as a T&E planning factor.

c. Use of the Threat TSP in Test Planning. The purpose of the Threat TSP is to document the threat environment appropriate to test a developing system. When reviewing the Threat TSP, the evaluator and tester must determine whether:

(1) Threat overview in the Threat TSP adequately reflects the threat assessment of the STAR.

(2) Threat scenarios have been validated and accurately replicate the test threat environment needed to address the critical issues.

(3) Weapon/target matrices adequately reflect the validated threat.

(4) The threat is appropriately configured for the environmental conditions and means of employment (doctrine, tactics, organization, and force structure) necessary to answer the issue focus of the TEP.

(5) Detailed test planning has been conducted with full cognizance of CIPs.

(6) Targets and threat simulators are available and scheduled to replicate the threat scenarios depicted in the Threat TSP. Consideration must also be given to the use of surrogates, (in the absence of appropriate targets or threat simulators) and the accreditation of all threat representative systems in advance of testing.

19-14. Validation and Accreditation

Validation and accreditation are applicable to all threat simulators and targets which are used to represent a specific threat system (or portion of a specific threat system) in developmental and/or operational tests. Laboratory simulators will be validated and accredited if they represent a part or function of a specific threat system and are used in a test supporting a milestone decision.

a. Validation.

(1) Definition. Threat simulators and targets are developed in order to portray threat systems for identified test support requirements. Accordingly, threat simulators and targets may duplicate or represent a limited number of attributes of the threat system. Validation is the process of comparing targets and threat simulators to DIA-approved threat data and documenting the differences so they can be factored into test and training planning, execution, and evaluation. Validation provides the analysis necessary to justify continuation of development or use, or modification to achieve or restore a sufficiently realistic representation. Thus, validation must be based upon expert knowledge of the threat, the simulator or target, and test requirements.

(2) Validation Working Group (VWG). Validation occurs and is documented by a VWG at the following key decision points during the life cycle of a threat simulator or target: Design Specification Review (DSR), Critical Design Review (CDR), Initial Operational Capability (IOC), upon modification which affects fidelity, and periodically following deployment. The VWG is chartered by TEMA, chaired by the TEMA designee, and composed of representatives from the responsible user, intelligence, and simulator/target development organizations. Mandatory membership includes representatives from TECOM, OPTEC, Army Materiel System Analysis Activity (AMSAA), and PM ITTS. "As Required" membership includes representatives from TRADOC, Army Research Laboratory (ARL), MSIC, FSTC, AMC Research, Development and Engineering Centers (RDEC), and other Army/Service organizations.

(3) Requirements. Validation requires technical and use analysis.

(a) Technical Analysis. Technical analysis compares the technical characteristics and capabilities of a threat simulator or target to current DIA-approved intelligence information on the specific threat system. A Technical Analysis Report (TAR) will quantify the fidelity of the threat simulator/target and the threat, and state the implications of differences. Technical analysis will use data developed jointly by the technical analysis organization (e.g., an S&TI Center) and the simulator/target developer to satisfy the DoD Tri-Service Executive Committee (EXCOM) standard validation criteria for threat simulators. The responsible S&TI Center will issue the TAR to the VWG.

(b) Use Analysis. "Use analysis," accomplished by the VWG, compares the capabilities and limitations of the threat simulator or target (described in the TAR), the threat, and the

projected general use of the system to determine its utility. "Use analysis" is documented (along with the technical analysis) in the validation report. Validation reports are submitted to the Army CROSSBOW-S Committee representative for appropriate staffing and approval.

b. Accreditation.

(1) Definition. Accreditation is the process used to assess whether threat simulators and targets are suitable for specific tests. It is essential for the following reasons:

(a) Identifies differences (even those accepted during development and validation) between threat simulators/ targets and the corresponding threat system which can prevent adequate representation of the threat in a particular test.

(b) Ensures timeliness of intelligence estimates support the use of a particular target/threat simulator in a specific test.

(c) Identifies deterioration and failures which can render a threat simulator or target inadequate to represent the threat.

(2) Approval. The accreditation of threat simulators and targets is accomplished by the Threat Accreditation Working Group.

(3) Data Requirements. In accreditation the data requirements of a particular test are compared to both the latest intelligence estimates and to the capabilities of the simulator or target (as reflected in current validation reports). Differences between the simulator or target and the intelligence data concerning the capabilities of the relevant threat system are analyzed and assessed against the critical test criteria. These differences are also assessed against Critical Intelligence Parameters (CIP), (defined in AR 381-11) to determine whether the performance characteristics and capabilities of the simulator/ target representing the threat are within established CIPs. Differences, particularly those exceeding the CIPs, which cannot be accommodated or offset in test planning, are defined and used to either justify modification of the simulator/target or support the decision to acquire alternate simulators or targets. Differences found to breach or exceed a CIP are reported to the TIWG/PM as a basis to define and assess the implications of an improved threat capability on the effectiveness, survivability, and cost to the U.S. system to be tested.

(4) Timing. Accreditation is required prior to the use of a threat simulator or target and must be incorporated into the planning and preparation for tests. The accreditation process complements the functions of the TIWG to improve test planning, specifically defines test resource requirements for the OTP, and provides guidance for further refinement of the Threat TSP.

c. Threat Accreditation Working Group (TAWG). The TAWG will assess, document, and report on threat simulator/target suitability/adequacy in support of specific tests.

(1) Establishment. A TAWG will be established in support of the TIWG for each test anticipating use of threat simulators and/or targets under the provisions of the U.S. Army Validation and Accreditation Plan for Threat Simulators and Targets.

(2) Membership. TAWG membership will be tailored to the U.S. system under consideration and will be composed of representatives from the responsible user, intelligence, developer, and operator/maintainer organizations. The chairman of the TAWG will be in accordance with guidance published by TEMA in the U.S.Army Validation and Accreditation Plan for Threat Simulators and Targets.

(3) Functions. Functions and responsibilities of the TAWG are outlined below. These functions/responsibilities also constitute the accreditation process.

(a) Verification. Compile and analyze test data requirements, in comparison to system threat data, to verify the need for identified threat simulators/targets and to quantify any additional threat simulator/target or data requirements.

(b) Representation. Examine test data requirements, threat data analysis, and simulator/target validation data to determine the ability of the simulator/target to adequately represent the threat system under specific test conditions.

(c) Documentation. Document, to the TIWG, the suitability of individual threat simulators/targets for use. The format for the accreditation report and transmittal letter are contained in the U.S. Army Validation and Accreditation Plan for Threat Simulators and Targets. This documentation may include any specific test limitations imposed and recommendations to use a particular threat simulator/target as is, only after modification, or not at all. Additionally, when a particular representation is required and available assets are deemed unsuitable, alternatives will be identified. Accreditation

reporting will be documented in the TEMP bibliography.

Section V
Inventory and Capability Accounting and Use

19-15. General
One of PM ITTS chartered responsibilities is to maintain a capability inventory of ITTS assets on hand at DoD and contractor test facilities and a data base of planned acquisitions. Currently, the primary repository for information on the Army's test capabilities is the Test Facilities (TESTFACS) Register. Ancillary data serves to support the Director, Test and Evaluation, OUSD(A) T&E Assets Data Base, and the Army portion of DoD's Major Range and Test Facility Base (MRTFB), Central Test and Evaluation Investment Program (CTEIP), Resource Enhancement Program (REP), and Operational Test and Evaluation Capability Improvement Program (OT&ECIP). The accounting hierarchy is depicted in Figure 19-3.

(INSERT FIGURE 19-3 HERE)

19-16. Test Facilities (TESTFACS) Register
TESTFACS is an automated program which lists and describes the Army's test capabilities. The TESTFACS data base consists of Major Test Facilities (MTF) and Major Instrumentation and Test Equipment (MITE) with values of $75K or more, including targets and threat simulators/actuals. The TESTFACS data base is updated on a periodic basis by using several options: manual input, on-line access via the Defense Switching Network (DSN), or personal computer floppy disc update. TESTFACS is intended to assist the Army in managing an orderly growth of test capability and serve as a basis for test planners, including TIWG, as well as providing a base of information for resource management. Manual input requirements and procedures are addressed in Figure 19-4. POC - Project Manager for Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS-I, Aberdeen Proving Ground, MD 21005-5001; DSN 298-2103, Commercial (410) 278-2103.

(INSERT FIGURE 19-4 HERE)

19-17. Associated Programs

a. OPTEC Instrumentation Data Base (OIDB). The OIDB is an automated inventory program that includes all ITTS assets owned and operated by OPTEC test activities. It identifies

instrumentation by category, class/subclass, quantity, and location. Refer to Commander, U.S. Army Operational Test and Evaluation Command, ATTN: CSTE-OPI, Park Center IV 4501 Ford Ave, Alexandria, VA 22302-1458; DSN 289-1388, Commercial (703) 756-1388.

b. T&E Assets Data Base. The Director, Test and Evaluation, (D,T&E) T&E Assets Data Base is an automated inventory which includes assets with a value of $1M or more. The data base is "on-line" and accessible via T&E Community Network (TECNET). It serves to support planning and to quantify DoD capability in the form of DoDD 3200.11-D, MRTFB Summary of Capabilities. Refer to Director, Test and Evaluation; DSN 227-4819, Commercial (202) 697-4819.

c. Joint Threat Simulator Handbook (JTSH). The JTSH is a classified listing and description of over 200 threat simulators available for use in support of testing. Descriptions include a side-by-side presentation of threat and simulator parametric values, to provide an indication of simulator fidelity, and, for the majority, photographs of the simulator. Intended as a "first look" data source, the handbook reflects inventory quantity and location and identifies points of contact for additional information. The JTSH is available in hardcopy or microfiche format from the Joint Electronic Warfare Center, San Antonio, TX, or Personal Computer (PC) compatible automated format through the CROSSBOW-S Management Office. Refer to Joint Electronic Warfare Center, San Antonio, TX 78243-5000; DSN 969-4705, Commercial (512)977-4705 or CROSSBOW-S Management Office, Pentagon; DSN 788-2802, Commercial (205) 842-2802

d. Targets Information Manual. This manual provides the organization and functions of the various elements of the Targets Management Office (TMO) and a descriptive catalog of Army targets available (or in development) for support of T&E or training. Refer to Project Manager for Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS-Q, Redstone Arsenal, AL 35898-5798; DSN 746-8678, Commercial (205) 876-8678.

Section VI
Schedule/Use Requirements

19-18. General
This section describes procedures to be followed when a user has a need for existing instrumentation, targets (including foreign materiel), and/or threat simulators which are not organic to the

parent test activity/directorate. It also discusses the procedures to follow when a need exists for new instrumentation, targets, or threat simulators.

19-19. Instrumentation
Individual test activities, directorates, ranges, and/or laboratories possess organic instrumentation assets consistent with their mission focus (e.g., tank automotive, electronics, missiles, combined arms, etc.).

a. Scheduling. Scheduling of organic assets is effected in consonance with internal operating procedures. Scheduling of assets from external sources is effected by direct coordination between the borrower and lender.

b. Conflict Resolution. Conflicts due to competing customer requirements and availability of assets will be resolved at the lowest level possible. Unresolved conflicts will be addressed by the Test Schedule and Review Committee (TSARC), within the scope of its charter, or by TEMA.

c. Issue/Turn-In Procedures. Issue/Turn-In of instrumentation assets is normally handled through property book officer channels. Borrowed assets will be returned in their original condition, unless other arrangements are pre-coordinated with the lender.

d. Costs. Costs associated with instrumentation use are normally limited to those of lease, round trip transportation (for borrowed instrumentation), and/or any modifications required for unique/special applications, interface requirements, etc. The latter are typically charged to the customer (e.g., PEO/PM). Costs will be reflected in the Outline Test Plan (OTP) for TSARC approved tests.

19-20. Targets

a. For TSARC approved tests, requirements for targets in support of tests will be included within the OTP. Individual test activities, directorates, ranges, and/or laboratories possess limited organic target assets. The vast majority of aerial and ground targets used in support of Army T&E are, however, developed/procured, maintained in inventory, and operationally supported by TMO. The procedures of this section therefore focus on TMO. Specific procedural requirements for assets held by other organizations should be coordinated directly with the appropriate POC.

b. Scheduling. Requests for use of assets controlled by TMO will be documented on SMI Form 1209). Requests should be submitted as soon as requirements are identified to allow TMO sufficient time to coordinate the schedules for the target hardware and associated support services. However, firm targets support requirements for the budget year and revised estimates for future years should be submitted to TMO NLT 1 April annually to ensure target support (flight services) contracts are in place on 1 October. A Flow Diagram depicting the processing of a request is shown in Figure 19-5. Refer to Project Manager for Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS-Q, Redstone Arsenal, AL 35898-5798; DSN 746-3990, Commercial (205) 876-3990.

(INSERT FIGURE 19-5) HERE

c. Conflict Resolution. Conflicts due to competing customer requirements and availability of assets will be resolved at the lowest level possible (either TMO or PM ITTS). Unresolved conflicts will be addressed by the Test Schedule and Review Committee (TSARC), within the scope of its charter, or by TEMA. TEMA will coordinate with the Joint Commanders Group for T&E (JCG[T&E]) to resolve any joint test requirements.

d. Issue/Turn-In Procedures.

(1) Aerial Targets. Aerial targets used in T&E are mostly government owned, contractor operated. The TMO furnishes trained contractor technicians who provide target presentations as a turnkey service. At an unusual site, the tester may need to be concerned with on-base facilitization of target operations. For the few aerial targets which are troop-operated, the tester must make arrangements for support personnel and requisition the targets through the supply system.

(2) Ground Targets. Ground targets are provided from a centralized pool of vehicles at various ranges. The ranges which normally operate ground targets will have government or contract personnel trained in their operation and maintenance. Other sites must either arrange for loan of personnel or obtain their own support. Issue and turn-in are arranged through a standard loan agreement. In general, the target user (tester) is responsible for repair of undestroyed targets prior to return. These new procedures are in the process of being optimized.

e. Costs. Funding of T&E targets beyond development is generally borne by the customer (i.e., the using Program/Project Manager or tester). Certain exceptions are made for training

targets which can support production testing. A funding logic flowchart is shown in Figure 19-6. Since many T&E targets are for special purposes and not normally held in inventory in anticipation of needs, they must be funded by the customer with procurement lead-time. This typically means that customer funding is needed about two years prior to the supported test. For TSARC approved tests, cost associated with targets will be included within the OTP.

(INSERT FIGURE 19-6 HERE)

19-21. Foreign Materiel
For TSARC approved tests, requirements for foreign materiel will be included within the OTP. Traditionally, foreign materiel available for use by the T&E community has been acquired under the auspices of AR 381-26, Army Foreign Materiel Exploitation Program, and held by the Foreign Science and Technology Center (FSTC). International events of the past several years, however, have resulted in the availability of an unprecedented number of foreign military assets and overloaded the FSTC capacity. These assets (i.e., foreign ground combat vehicles), many of which have been designated for use as targets by the T&E community, are currently in the possession of AMC, with PM ITTS designated as the management agent. The Targets Management Office (TMO) will execute the activities associated with the management of foreign materiel. Under the reliance concept, these assets will be available for use to all members of the DoD community. A Central Asset Pool (CAP), planned for Yuma Proving Ground (YPG), Arizona, will serve as a central storage facility and center of expertise for storing, preparing for use, and shipping of foreign assets. Detailed procedures for management, control, operation, and support of foreign materiel are currently under development; however, for interim use, the procedures described below apply.

a. Scheduling. TMO will provide central control over foreign assets by coordinating asset use and maintaining accountability. Requests, submitted via a Foreign Equipment Request to TMO, will be considered based on asset availability and priority of need as indicated above for targets. All requests for destructive testing will be subject to approval by the Army Foreign Materiel Review Board (AFMRB). All operation and maintenance (O&M) of foreign materiel must be performed by CSTA-trained personnel. Thus, provisions must be made at the time of scheduling to ensure that certified personnel will be available to conduct required O&M functions. While this requirement may impose some restrictions on scheduling flexibility, these procedures are necessary to maximize the safety of test personnel and ensure adequate operational fidelity while minimizing potential damage

to the equipment. Refer to Project Manager for Instrumentation, Targets and Threat Simulators, ATTN: AMCPM-ITTS-Q, Redstone Arsenal, AL 35898-5798; DSN 746-3099/ 788-6797, Commercial (205) 876-3099/842-6797.

b. Conflict Resolution. Requests for use of foreign materiel will be prioritized using the criteria listed below. Conflicts due to competing customer requirements and availability of assets will be resolved at the lowest level possible (either TMO or PM ITTS). Unresolved conflicts will be addressed to TEMA for resolution. TEMA will also coordinate with the Joint Commanders Group for T&E (JCG[T&E]) to resolve any joint test requirements.

(1) Satisfying many versus few users.

(2) Short term versus long term allocation of assets.

(3) Non-destructive versus destructive testing.

(4) DCSOPS weapon system priority.

c. Issue/Turn-In Procedures. After approval of a foreign military asset use request, TMO will direct the CAP to prepare and ship the foreign asset(s) to the requested location. Unless otherwise directed by TMO, the user will return the foreign asset(s) to the CAP after use. A loan agreement will be used to define responsibilities and conditions for the use of foreign assets. A sample is shown at Figure 19-7.

(INSERT FIGURE 19-7 HERE)

d. Costs. Details for funding the management, operations, and support of foreign assets will be developed as responsibilities of and relationships between various support agencies and customers are more clearly defined. A mixture of institutional and customer funding will be used for the support of the CAP, with the customer bearing all costs associated with foreign materiel asset use (e.g., transportation to and from the test location, operation and support of the asset on site, and maintenance and/or repair upon return to the CAP).

19-22. Threat Simulators
For TSARC approved tests, requirements for threat simulators will be included within the OTP. As defined, threat simulators are a family of equipment used to represent adversary systems. Army Threat Simulators (ATS), developed by PM ITTS and subject to provisions of the U.S. Army Validation and Accreditation Plan for Threat Simulators and Targets, are normally "fielded" to the

OPTEC Threat Support Activity (OTSA) for operation and maintenance. The procedures of this section therefore focus on OTSA. Specific procedural requirements for assets held by other organizations (e.g., Electronics Proving Ground [EPG], Vulnerability Assessment Laboratory [VAL], and TEXCOM Intelligence and Electronic Warfare Test Directorate [IEWTD]) should be coordinated directly with the appropriate POC.

a. Scheduling. The OIDB provides a list of threat simulators available at OTSA. Additional assets and information are addressed in the Joint Threat Simulator Handbook. Scheduling of OTSA held threat simulators is accomplished directly with OTSA and should be effected no later than 24 months in advance of the required test date. Formal schedule coordination and approval for use is conducted as a part of the TSARC process. Priority for use is based on the hierarchy listed below. Refer to Director, U.S. Army Operational Test and Evaluation Command OPTEC) Threat Support Activity (OTSA), ATTN: CSTE-OPO, Fort Bliss, Texas 79916-0058; DSN 978-3123/7709, Commercial (915) 568-3123.

(1) TSARC approved test.

(2) Non-TSARC Army test.

(3) Non-Army test.

(4) Training support.

b. Conflict Resolution. OTSA will address conflicts on a case by case basis and develop a threat simulator usage schedule that best accommodates all parties involved. Conflicts that cannot be resolved at the OTSA-customer level will be elevated for resolution to the TSARC, within the scope of its charter, or to TEMA.

c. Issue/Turn-In Procedures. Threat simulators held in inventory by OTSA are not "issued" for use by the T&E community. Instead, OTSA personnel execute all aspects of threat simulator activity during testing. This is done because of the requirement for trained operator and maintenance personnel to optimize performance of the simulator.

d. Costs. For all types of test and training support, OTSA will prepare a cost estimate and provide a summary sheet to HQ OPTEC (CSTE-OPI) for use in communication and coordination with the customer. For TSARC approved tests, costs associated with threat simulator support (drawn from the summary sheet) will be

included within the Outline Test Plan (OTP). For other tests and training support, the designated test activity will ensure that funds or Funds Certification/Availability letters are obtained to underwrite costs of the required support. OTSA threat simulator support costing for TSARC approved tests includes TDY costs (including rental cars); transportation of equipment (round trip); special training of operators as required; petroleum, oil, and lubricants; overtime; unique instrumentation, including interfacing, data acquisition, and processing equipment; supplies; repair parts associated with degradation of the system; and any additional personnel resources required to support the effort. For other test and training support, the customer will also provide funds for core contract costs (those associated with the support contractor's normal day-to-day operations including base pay and overhead) during the required support time frame as determined by OTSA, and a usage fee based on maintenance cost per day (X) number of days (X) 10%.

Section VII
Development and Acquisition Requirements

19-23. General
The process discussed in this section provides general information for the tester and instrumenter who is unable to fulfill needs from inventory. Throughout the process, requirements are discussed as though they pass through each review favorably. An actual requirement may fail to pass through a certain review, and may be passed to an earlier point in the cycle for revision or reconsideration and subsequent resubmission or deletion. It must be noted that the ITTS acquisition process, from the identification of a need to the availability of a fielded system, routinely takes three to five years and may take significantly longer (e.g., 10-12 years) for certain major systems. For this reason, Requirers must adjust their planning and resourcing efforts accordingly for immediate needs.

19-24. Relationships
Various programs (e.g., sustaining instrumentation) are funded and pursued at the command level. Key among these are the TECOM Technology Development and Acquisition Program (TDAP), which calls for TECOM test centers to relate shortfalls (and therefore projects) to specific facilities in TESTFACS; and the OPTEC User Test Instrumentation Program (UTIP). Requiring commands (e.g., TECOM and OPTEC) and PEO/PM are encouraged to maintain communications with PM ITTS concerning requirements to enable rapid identification of any cases of duplication or potential savings which may be gleaned from combining the development of similar projects. Further, communication with PM ITTS will

facilitate community-wide awareness of instrumentation, target, and threat simulator developments and thereby enhance inter-command coordination and technology sharing. The result will be reduced costs and a more effective and efficient Army ITTS program. Due to significant changes ongoing throughout the Army, major changes to this process will occur in the near-term (i.e., next several months to a year). Currently, the process, as described is an accurate representation of the procedure to follow when requesting ITTS developments. As major changes occur, the process description will be updated to reflect those changes.

19-25. Process
Each step of the ITTS requirements process is identified by the documents which are input to the process, a brief statement of the actions in the process, and a description of the documents which are output from the process. The Originators and Recipients are listed where applicable. Because some steps of the process differ for the development of instrumentation versus that of targets and threat simulators, this section is divided into three distinct subsections: one, steps unique to the instrumentation cycle; two, steps unique to the target and threat simulator cycle; and three, steps common to both cycles. A composite graphic, depicting the full cycle, is presented at the end of the section.

19-26. Instrumentation Cycle

a. Requirements Document Generation (See figure 19-8). The Originator (usually a test directorate or test center; occasionally a command headquarters or program/project manager, which may also serve as the Requirer) generates the requirement document. Major instrumentation requirements are documented in accordance with DoD 5000.2-M. Sustaining instrumentation requirements are documented in the format of the parent command (e.g., TECOM or OPTEC). Prior to this step, the Originator has verified that the need is valid and determined that a development effort is necessary through a documented reference to the Army Technology Base Master Plan, Five Year Test Program (FYTP), various Test Integration Working Group (TIWG) minutes, the Test and Evaluation Master Plan (TEMP), or any other applicable documents. The Evaluator and PM ITTS participate as required. In summary, the lead organization is the Originator (occasionally the Requirer); the Originator generates requirement and performs preliminary analysis; the inputs are verbal or written statements of needs which may impact the T&E community; the outputs are the ORD (major), or requirement document (sustaining); and the recipient is the Requirer. Needs are

derived primarily from the sources listed below.

(1) Current and planned testing of new technology, materiel, tactics, or doctrine. These needs should be identified by TIWGs and documented in TEMPs at the earliest possible stage of development. Test technology needed to maintain state-of-the-art capability is usually identified in reports such as Technology Base Master Plan (TBMP), Next Generation/Future Systems (NG/FS) Handbook, AMC Future Test and Evaluation Requirements (AFTER) Report, and U.S. Army Research Laboratory (ARL) reports.

(2) Major Range and Test Facility Base (MRTFB) Infrastructure. Needs which support DoD-directed testing capabilities are identified by test activities and documented in reports such as Long Range Business and Modernization Plans.

(INSERT FIGURE 19-8 HERE)

b. Requirement Review and Consolidation (See figure 19-9). The Requirer reviews all requirements, checks for unwarranted duplication, and confirms adherence to the command long range plan. Following consolidation of all submissions, the Requirer prioritizes sustainment requirements for execution, in consonance with available funding, and identifies and nominates, in ORD format, potential major systems for PM ITTS management. In summary, the lead organization is the Requirer; the Requirer consolidates Command requirements; inputs are ORD (major), or requirement document (sustaining); the outputs are the requirements; and the recipient is PM ITTS.

(INSERT FIGURE 19-9 HERE)

c. ORD Review and Passage of Sustaining Requirements to PM ITTS (See figure 19-10). PM ITTS reviews the ORD and coordinates with the Requirer to gain an understanding of the need. PM ITTS gains visibility of the sustaining requirements from the information copies provided by the Requirer. In summary, the lead organization is PM ITTS; PM ITTS reviews the ORD and resolves any questions with the Requirer, while the Requirer provides information copies of sustaining requirements to PM ITTS for subsequent examination and potential consolidation among requirers; inputs are the ORD, and an information copy of the sustaining requirements; the outputs is the ORD; and the recipient is PM ITTS.

(INSERT FIGURE 19-10 HERE)

d. ORD Consolidation (See figure 19-11). PM ITTS reviews the ORD to identify duplication or opportunity for common development with other ORDs or instrumentation. PM ITTS may, in coordination with the Requirer, develop a single ORD to consolidate multiple ORDs with identical or similar requirements. ORDs identified for consolidation are staffed to the affected Requirers and the entire list of ORDs are staffed to the various Requirers throughout the Army for comparative review. PM ITTS also advises affected Requirers of any potential for combining sustaining requirements. In summary, the lead organization is PM ITTS; PM ITTS reviews the ORD and sustaining requirements and, where opportunities for common development exist, PM ITTS combines requirements in accordance with requiring activities; inputs are the ORD, and information copies of the sustaining requirements; the outputs is the ORD; and the recipient is the Army instrumentation community.

(INSERT FIGURE 19-11 HERE)

19-27. Target/Threat Simulator Cycle

a. ORD Generation (See figures 19-12 and 19-13). The Originator (usually a PM, PEO, evaluator, OPTEC, Space Defense Command [SDC], TRADOC, or TECOM) generates an ORD in accordance with DoD 5000.2-M. In summary, the lead organization is the Originator (occasionally the Requirer); the Originator generates the ORD; inputs are the requirements; the outputs is the ORD; and the recipient is PM ITTS.

(INSERT FIGURE 19-12 HERE)

(INSERT FIGURE 19-13 HERE)

b. ORD Review (See figure 19-14). PM ITTS reviews the ORDs and resolves any questions with the Originator. PM ITTS also reviews the ORD to identify duplications with other ORDs. PM ITTS will identify those requirements which may be combined and work with the individual originators and requirers to consolidate those requirements. In summary, the lead organization is PM ITTS; PM ITTS reviews the ORD; the input is the ORD; the outputs is the ORD; and the recipient is the Army ITTS community.

(INSERT FIGURE 19-14 HERE)

19-28. Common to Both Cycles

a. ITTS Requirements Conferences (See figure 19-15). PM ITTS hosts three annual conferences (one each for instrumentation,

targets, and threat simulators) to review and validate decisions to consolidate similar major ORDs from various Requirers within the Army. Requirers will attend and Originators and Evaluators may attend to ensure that only necessary development and acquisition efforts are initiated and that similar requirements are incorporated into a single ORD wherever possible. The conferences also provide fora to discuss other ITTS issues as appropriate. In summary, the lead organization is PM ITTS; each Army ITTS community activity participates in an individual PM ITTS requirements conference (e.g., one conference each for the instrumentation community, targets community, and threat simulator community) to review and validate consolidation decisions; inputs are the ORDs, in original, revised, or combined status; the outputs are the ORDs; and the Recipient is the GOSC. Outputs from the conferences will follow one of the two paths discussed below.

(1) Sustaining instrumentation requirements are returned to the Requirer for internal execution.

(2) ORDs (for targets and threat simulators [TTS] and major instrumentation) are presented to the GOSC for approval of further planning actions.

(INSERT FIGURE 19-15 HERE)

b. GOSC Review (See figure 19-16). The GOSC reviews the results of the instrumentation and TTS ORD generation procedures and authorizes PM ITTS to conduct appropriate planning, analyses, and reviews. Note should be made that this GOSC meeting is held concurrently with the GOSC meeting mentioned later in the cycle. A single convening of the GOSC serves to review and approve programs planned for future PM ITTS management and programs already under PM ITTS management. In summary, the lead organization is the GOSC; the GOSC reviews the requirements; inputs are the ORDs from both TTS and instrumentation cycles; the output is approval for planning; and the Recipient is PM ITTS.

(INSERT FIGURE 19-16 HERE)

c. Preliminary Analyses (See figure 19-17). PM ITTS, in concert with the Originators and Requirers, performs, contracts, or delegates preliminary trade-off analyses for each ORD. Examples of analyses include the COEA, Economic Analysis (EA), Comparative Analysis (CA), Study of Intended Use (SIU), Technological Opportunity Analysis (TOA), and Functional Requirements Identification (FRI). Subsequent to these analyses,

a PTA is recommended. The lead organization is PM ITTS; PM ITTS conducts preliminary analyses and reviews; the input is planning approval from the GOSC; the outputs are the Preliminary Technical Approach (PTA) requirements; and the Recipient is PM ITTS.

(INSERT FIGURE 19-17 HERE)

d. GOSC Approval (See figure 19-18). The GOSC reviews programs, which now have an initial cost estimate, for requirements approval. Subsequent to GOSC approval, the requirements are passed to the MSTIRC solutions cycle, OTECC, and CROSSBOW-S Committee reviews for multi-service coordination. The requirements also enter the Program Objective Memorandum (POM) and Long Range Army Materiel Requirements Plan (LRAMRP) process. The lead organization is the GOSC; the GOSC approves the requirements; the inputs are the Standard Army Quad Chart requirements approval and the PTA; the output is GOSC approval; and the Recipient is PM ITTS.

(INSERT FIGURE 19-18 HERE)

e. Concept Baseline Establishment (See figure 19-19). PM ITTS initiates an IPS and other project management documentation to create a Concept Baseline (cost, schedule, performance, supportability) for each project. The results of the GOSC decision will be incorporated into the baseline development. The lead organization is PM ITTS; PM ITTS creates the Concept Baseline; the input is the PTA; the output is the Concept Baseline; and the Recipient is the milestone decision authority.

(INSERT FIGURE 19-19 HERE)

f. Milestone I (MS I), Concept Demonstration Approval (See figure 19-20). The milestone decision authority (usually PM ITTS, but may also be AMC, DA, or DoD for special interest programs, e.g., the Mobile Automated Instrumentation Suite [MAIS]) reviews the programmatic documentation (e.g., IPS, COEA, etc.) with reference to the ORD. If satisfactory, the Concept Baseline is approved. This process continues through the acquisition management steps (Best Technical Approach, Development Baseline, specification, Production Baseline, production/deployment, and sustainment). In summary, the lead organization is the milestone decision authority; the Concept Baseline is approved; the input is the Concept Baseline; the output is MS I approval; and the recipient is PM ITTS.

(INSERT FIGURE 19-20 HERE)

g. Joint Service Reviews (See figure 19-21). PM ITTS leads joint service reviews. The outputs are generally MSTIRC, OTECC, and CROSSBOW-S Committee findings.

(INSERT FIGURE 19-21 HERE)

(1) MSTIRC Solutions Review. MSTIRC reviews DT&E and OT&E inputs for a formal working-level multi-service review of all requirements. As a result, potential CTEIP candidates and multi-service duplications are identified. MSTIRC submission formats currently vary between Need Cycle inputs (which do not include dollar values on projects) and Solution Cycle inputs (which consist of quad charts and extensions identifying schedules and budgets). Currently, MSTIRC requires the use of TELRIP format for input, although suggestions have been made that other formats may supersede TELRIP in the near future, and that the Need/Solution cycle split may be converted to a single format. To accommodate all of these variations, the term "required MSTIRC submission format" is used to define the input documentation. In summary, the lead organization is the MSTIRC; the MSTIRC reviews DT&E and OT&E inputs; the outputs are the findings of the MSTIRC; and the recipient is PM ITTS.

(2) OTECC Review (for OT&E requirements only). The OTECC reviews OT&E quad charts in coordination with other OT&E requirements from the other Services. As a result, potential REP candidates and multi-service duplications are identified. In summary, the lead organization is the OTECC; the OTECC reviews OT&E inputs; the outputs are the findings of the OTECC; and the recipient is PM ITTS.

(3) CROSSBOW-S Committee Review (for threat simulator requirements only). The CROSSBOW-S Committee reviews Army Threat Simulator requirements in coordination with threat simulator requirements from the other Services, and reports to the EXCOM. The EXCOM and CROSSBOW-S Committee use these findings to recommend the lead service for joint developments and identifies those programs considered to be unnecessarily duplicative. In summary, the lead organization is the CROSSBOW-S Committee; the CROSSBOW-S Committee reviews threat simulator inputs; the outputs are the CROSSBOW-S Committee findings; and the recipient is PM ITTS.

(4) Incorporate MSTIRC, OTECC, and CROSSBOW-S Committee Findings. PM ITTS adjusts programs and coordinates with other Services as applicable to accommodate MSTIRC, OTECC, and CROSSBOW-S Committee findings. These adjustments include participation in the formation of Joint Project Offices (JPO),

where applicable. In summary, the lead organization is PM ITTS; PM ITTS incorporates findings from the MSTIRC, OTECC, and CROSSBOW-S Committee reviews; the inputs are the MSTIRC, OTECC, and CROSSBOW-S Committee findings; and the outputs are adjusted programs.

h. Milestone IV (MS IV), Major Modification Approval. MS IV reviews are scheduled as required at any point after MS I whenever the Requirer determines that modification or upgrade to a target, threat simulator, or major instrumentation system in development or production is necessary due to additional required test capabilities. Modifications to systems not in production compete with other possible alternatives during a new Concept Exploration and Definition phase. In summary, the lead organization is PM ITTS; the output modification approval to determine phase point to start upgrade program. The entire requirements process is depicted in figure 19-22.

(INSERT FIGURE 19-22 HERE)

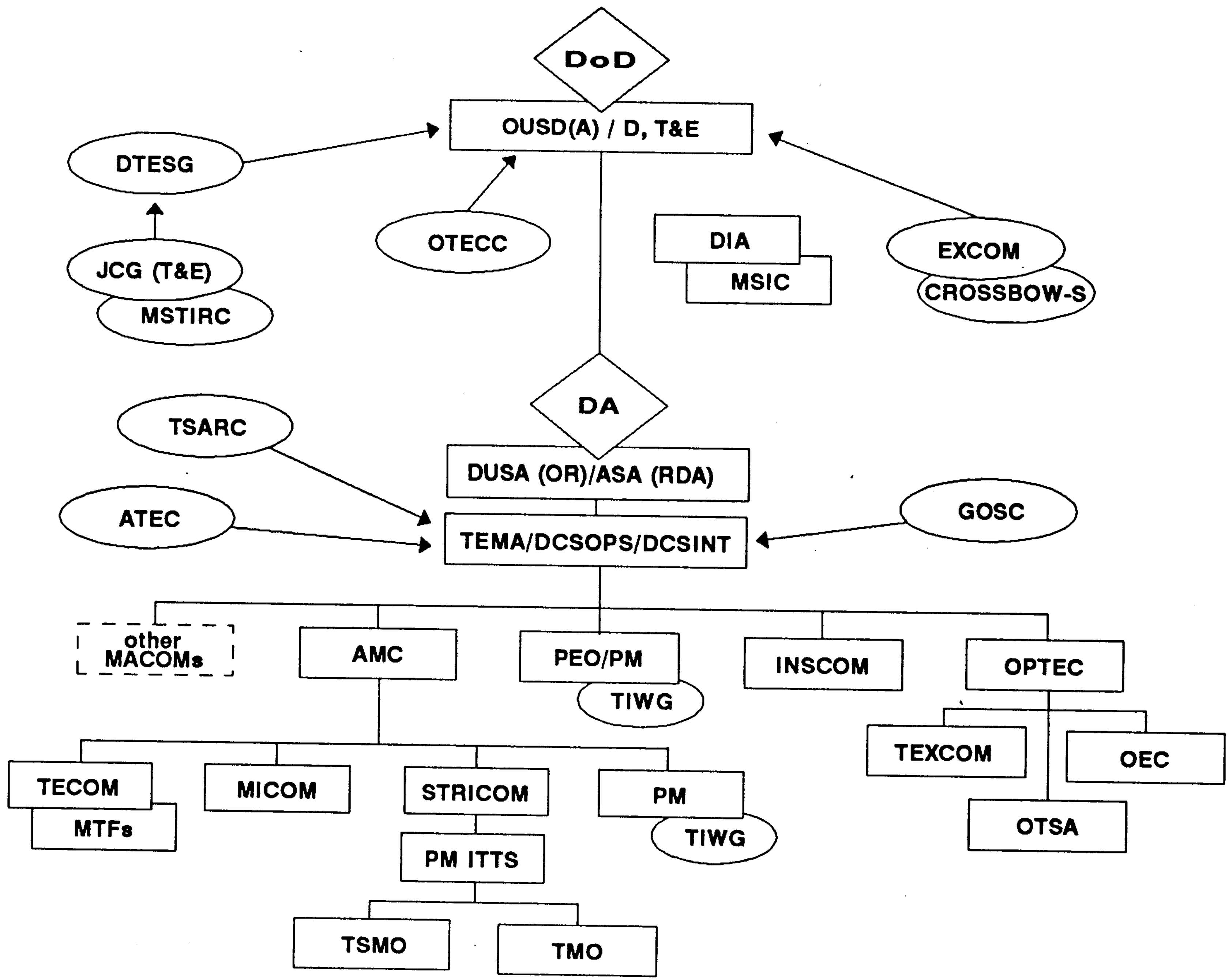

DoD
OUSD(A) / D, T&E
DTESG
OTECC
DIA
MSIC
EXCOM
CROSSBOW-S
JCG (T&E)
MSTIRC
DA
TSARC
DUSA (OR)/ASA (RDA)
ATEC
TEMA/DCSOPS/DCSINT
GOSC
other MACOMs
AMC
PEO/PM
TIWG
INSCOM
OPTEC
TEXCOM
OEC
TECOM
MTFs
MICOM
STRICOM
PM
TIWG
OTSA
PM ITTS
TSMO
TMO

FIGURE 19-1

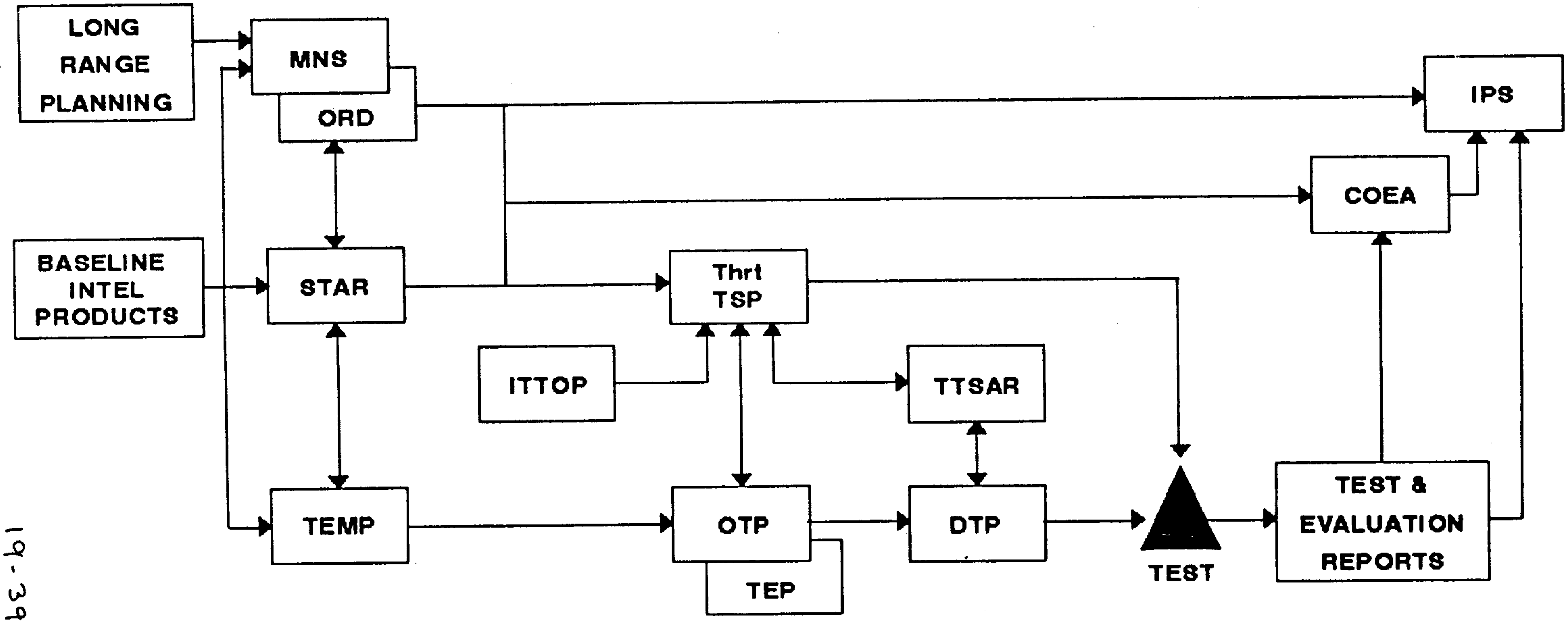

LONG RANGE PLANNING
MNS
ORD
IPS
BASELINE INTEL PRODUCTS
STAR
COEA
Thrt TSP
ITTOP
TTSAR
TEMP
OTP
TEP
DTP
TEST
TEST & EVALUATION REPORTS

FIGURE 19-2

CAPABILITY ACCOUNTING
INSTRUMENTATION

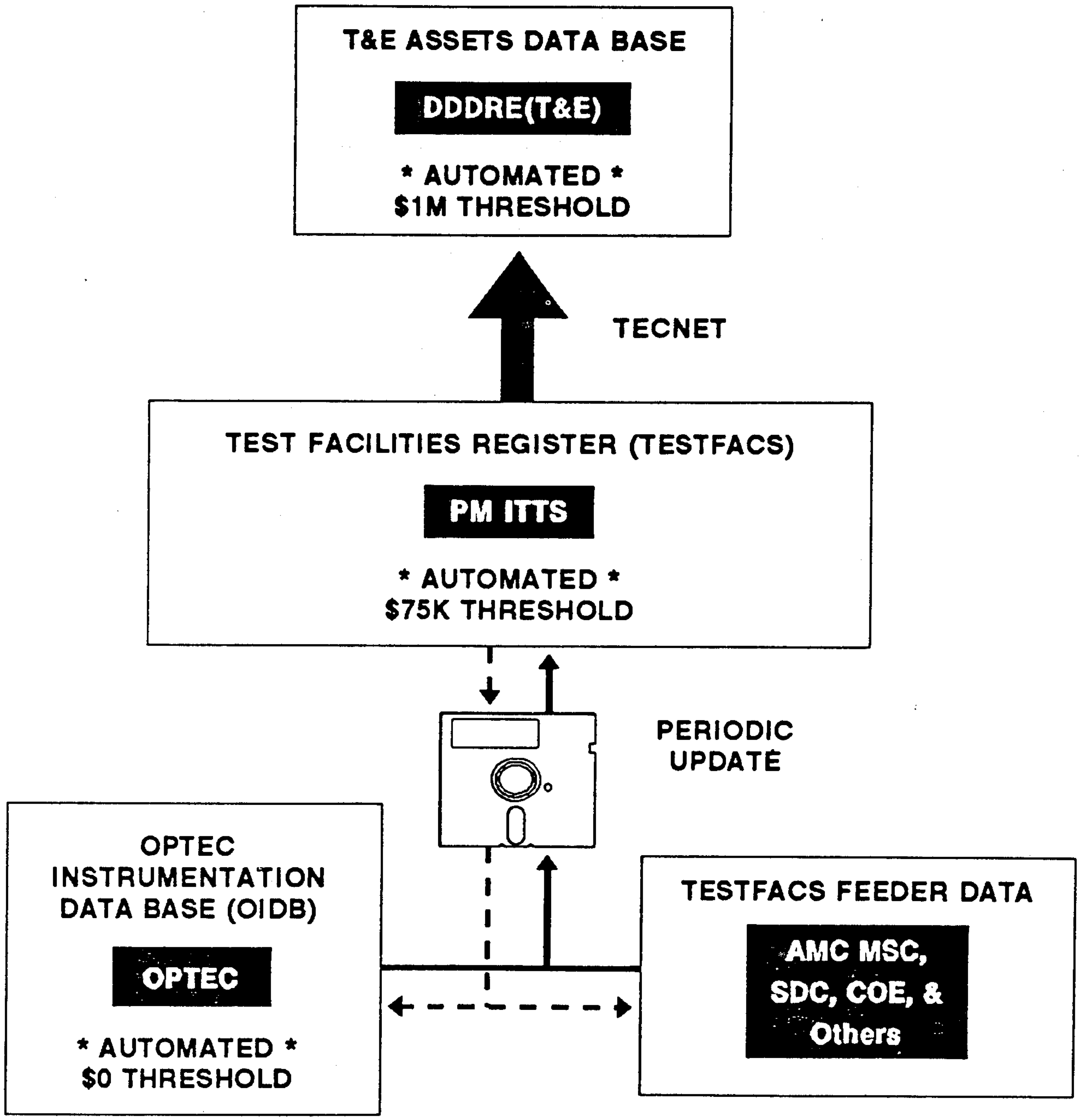


FIGURE 19-3

TEST FACILITIES (TESTFACS) REGISTER

Contained herein are TESTFACS manual input forms (locally reproducible), applicable completion instructions, and necessary data field codes.

1. AMC Form 2434-R, Installation/Activity, used to describe the installation, laboratory, proving ground, activity, or center being reported.

2. AMC Form 2434-1-R, Major Test Facility, used to identify major test facilities (MTF) which belong to the reporting installation, activity, etc.

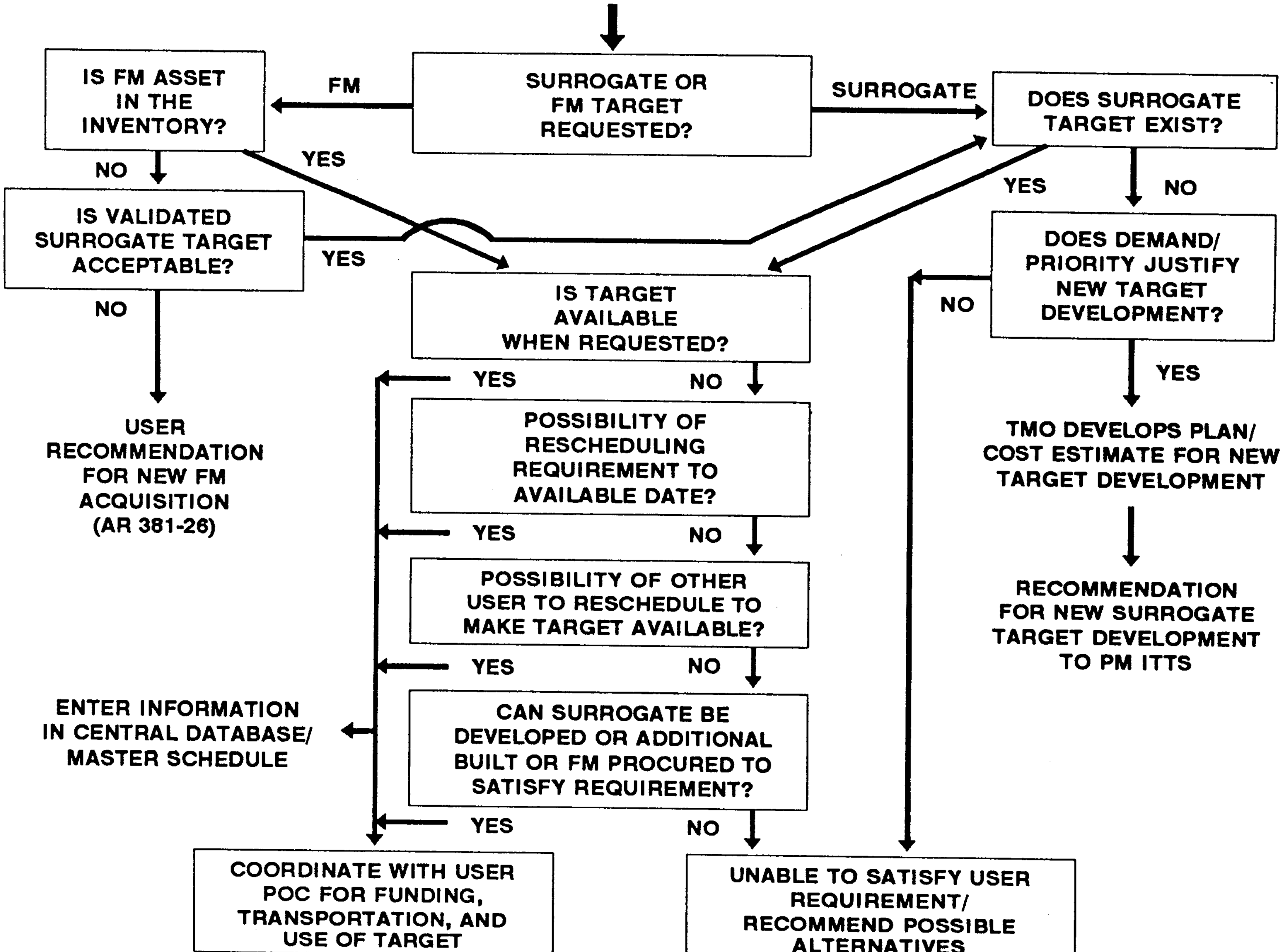
3. AMC Form 2434-2-R, Major Test Facility, used to describe the MTF which are identified as line items on AMC Form 2434-1-R.

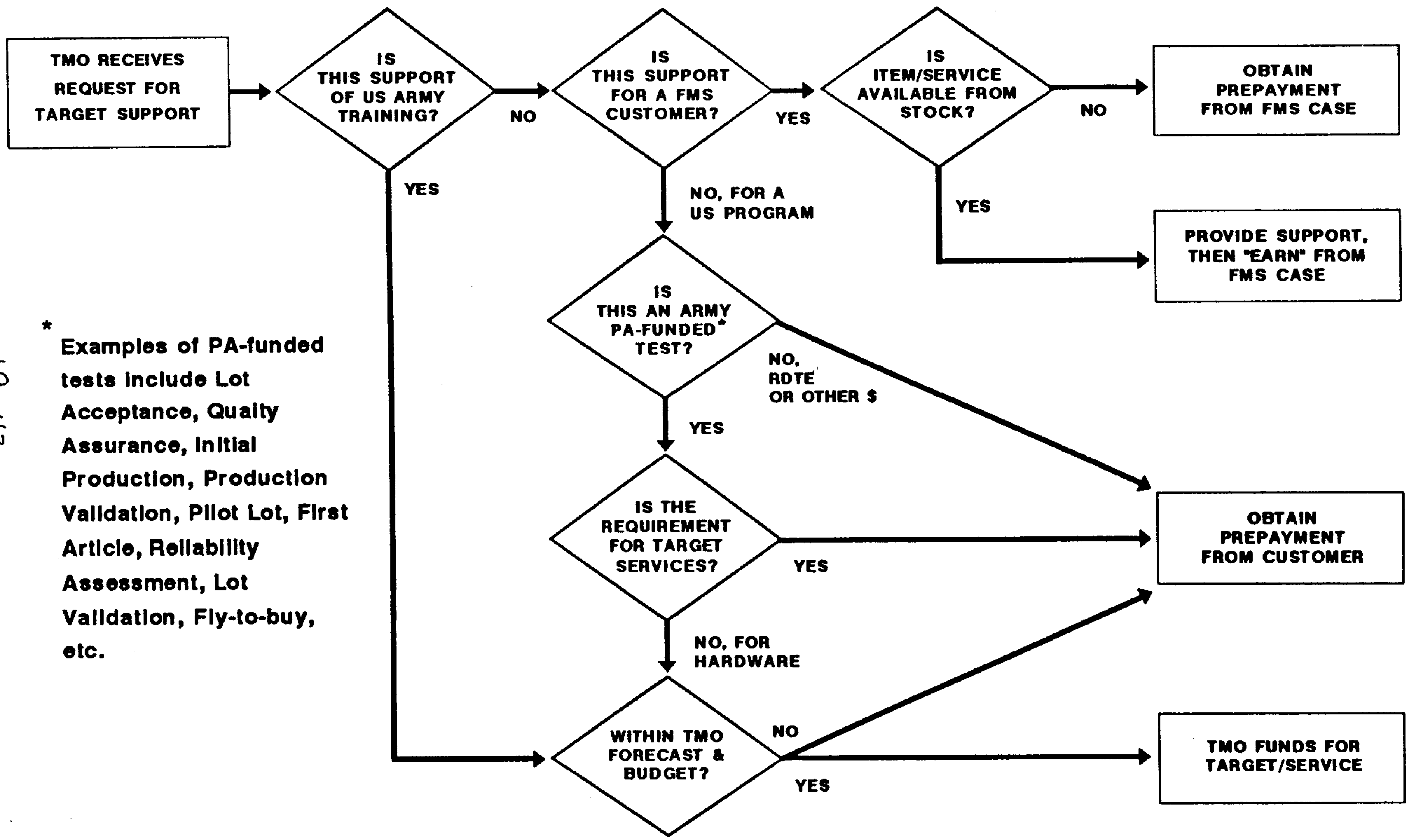
4. AMC Form 2434-3-R, Major Instrumentation/Test Equipment, used to describe instrumentation/test equipment costing $75K or more.

5. AMC Form 2435-R, TESTFACS Inventory Input Worksheet, used to enter inventory into the TESTFACS database.

FIGURE 19-4. TEST FACILITIES (TESTFACS) REGISTER

CUSTOMER REQUEST
FOREIGN MILITARY (FM) ASSET OR SURROGATE





* Examples of PA-funded tests include Lot Acceptance, Qualty Assurance, Initial Production, Production Validation, Pilot Lot, First Article, Reliability Assessment, Lot Validation, Fly-to-buy, etc.

FOREIGN EQUIPMENT REQUEST

1. TEST TITLE: ____________________

2. MATERIEL PROGRAM: ____________________

3. SYSTEMS REQUIRED:

SYSTEM	NO. REQUIRED

4. DESCRIPTION OF SYSTEM USE: ____________________

5. TIMEFRAME: REQUIRED BY: ____________________
   LOAN TIMEFRAME: ____________________

6. LOCATION: (SHIPPING ADDRESS): ____________________

7. DESTRUCTIVE OR NON-DESTRUCTIVE: ____________________

   IF DESCRUTIVE, DESCRIBE EXPECTED DAMAGE:

8. WHAT SUBSYSTEMS NEED TO BE OPERATIONAL?

9. ARE FUNDS AVAILABLE FOR: SHIPPING ____________________
   MAINTENANCE ____________________
   DAMAGE REPAIR ____________________
   OPERATION ____________________

10. POINT OF CONTACT: (PERSON RESPONSIBLE FOR SYSTEM)

    NAME ____________________
    TELEPHONE ____________________

FIGURE 19-7

INSTRUMENTAT
CYCLE

Originator

GENERATES
REQUIREMENTS AND
PERFORMS PRELIMINARY
ANALYSIS

Rqmts →

(Evaluator and PM ITTS will

FIG 19-8
19-45

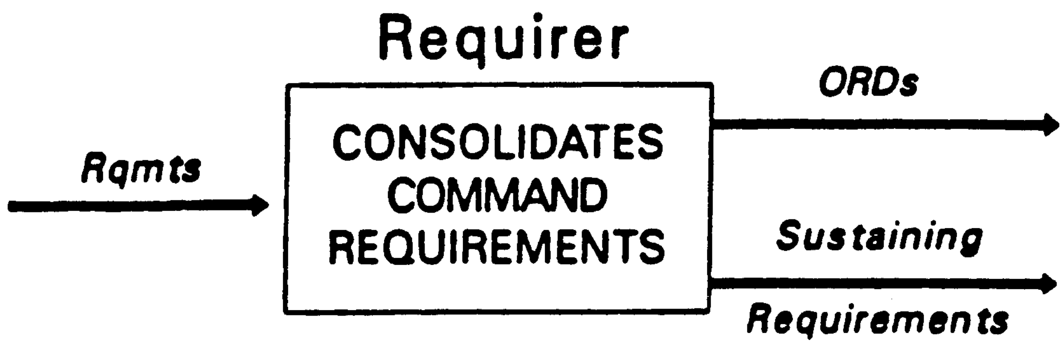

Requirer
Rqmts
CONSOLIDATES COMMAND REQUIREMENTS
ORDs
Sustaining Requirements

FIG. 19-9

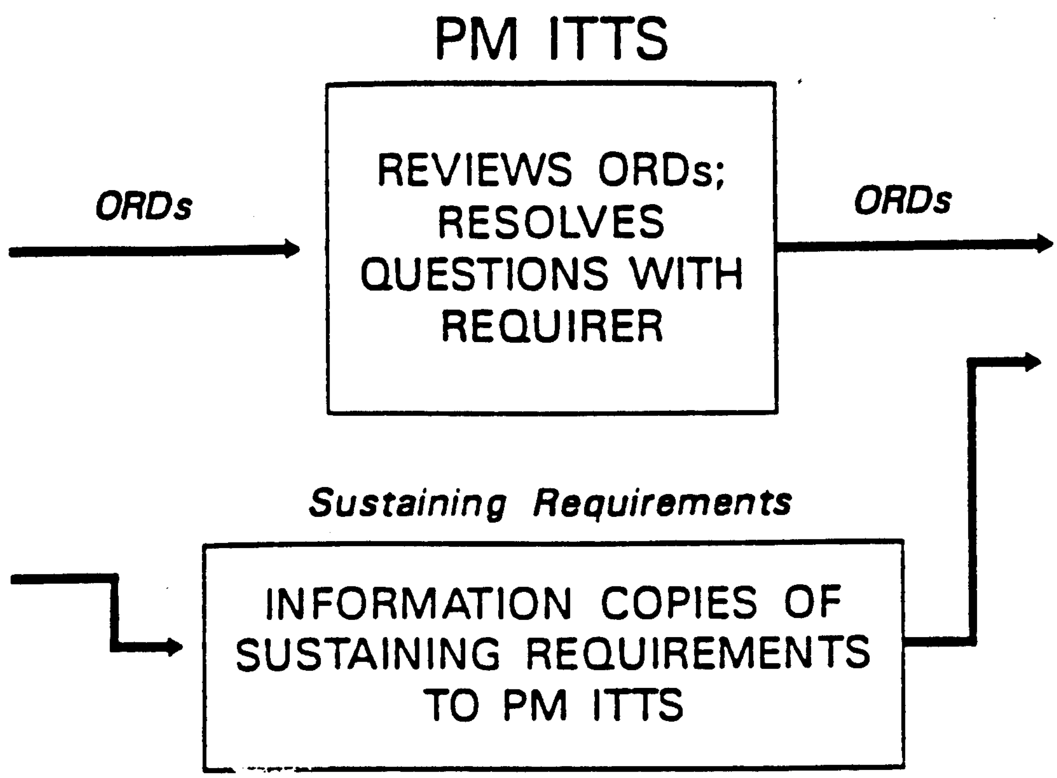

PM ITTS
ORDs
REVIEWS ORDs; RESOLVES QUESTIONS WITH REQUIRER
ORDs
Sustaining Requirements
INFORMATION COPIES OF SUSTAINING REQUIREMENTS TO PM ITTS

FIG 19-10

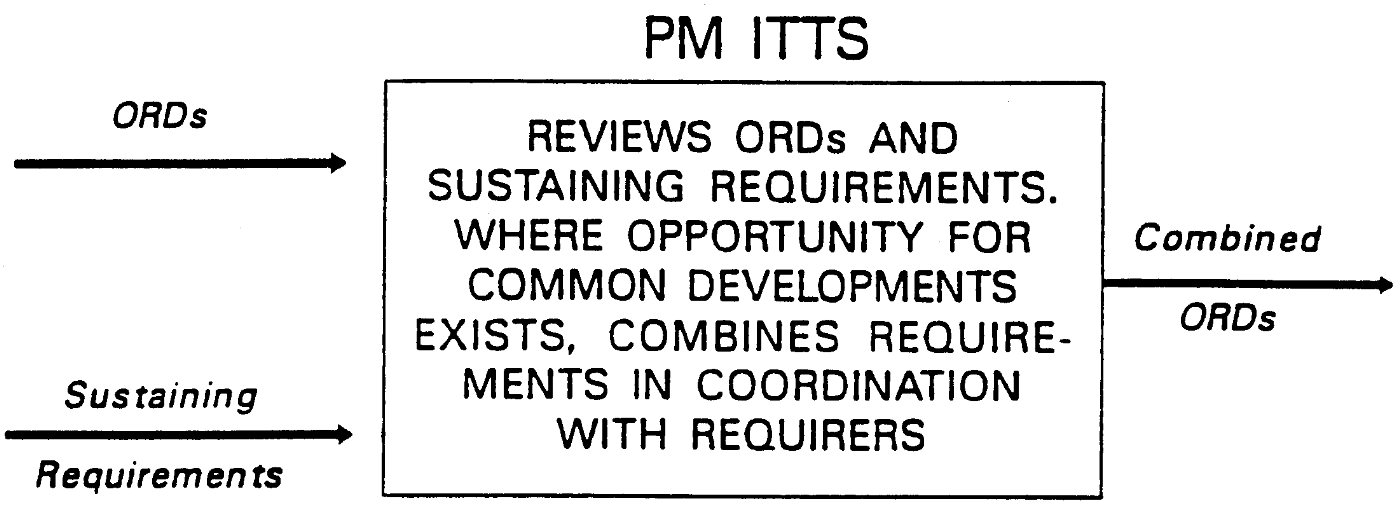

PM ITTS
ORDs
Sustaining
Requirements
REVIEWS ORDs AND SUSTAINING REQUIREMENTS. WHERE OPPORTUNITY FOR COMMON DEVELOPMENTS EXISTS, COMBINES REQUIREMENTS IN COORDINATION WITH REQUIRERS
Combined
ORDs

Fig 19-11

TTS CYCLE

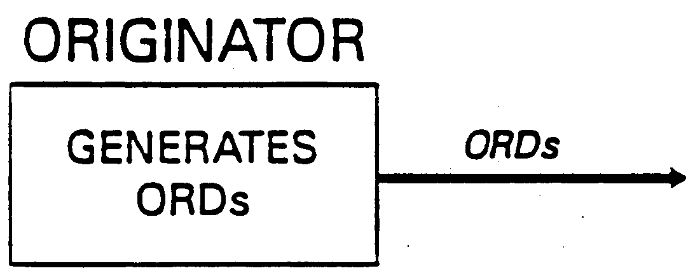


FIG 19-12

19-49

OPERATIONAL REQUIREMENTS DOCUMENT (ORD)

Operational Requirements Documents for ITTS systems will adhere to the format and content requirements of DoD 5000.2-M. Exceptions, clarification, and/or additional information/data requirements are set off in boxed paragraphs following the DoD 5000.2-M text. Necessary abbreviation of paragraph content is authorized, provided key project elements are adequately addressed. Brief rationale will be provided for any paragraph determined to be not applicable.

OPERATIONAL REQUIREMENTS DOCUMENT

FOR

PROJECT TITLE

The project title will be descriptive of the instrumentation system or threat system (or portion thereof) required.

1. General Description of Operational Capability. Describe the overall mission area, the type of system proposed, and the anticipated operational and support concepts in sufficient detail for program and logistics support planning. Include a brief summary of the Mission Need Statement. If a Mission Need Statement did not precede the Operational Requirements Document, explain the process that investigated alternatives for satisfying the mission need and developing operational requirements.

System description will make use of mission related terms and concentrate on the end result or main function that the item will perform, rather than on the nature of its design.

2. Threat. Summarize the threat to be countered and the projected threat environment. This threat information should

Figure 19-13. Operational Requirements Document

reference Defense Intelligence Agency or Service Technical Intelligence Center approved documents and be validated by the Service Intelligence Director. For major defense acquisition programs (acquisition category I), reference the Defense Intelligence Agency (DIA)-validated System Threat Assessment Report. In some non-warfighting systems, the threat may be listed as not applicable.

For instrumentation, this section should contain a brief description of applicable aspects of the threat the system is designed to capture. This can be extended to include the environment as a threat. For threat simulators and targets, this section should contain a brief description of the threat system to be replicated.

3. Shortcomings of Existing Systems. Describe why existing systems cannot meet current or projected requirements (do not describe a proposed system).

Description will include what shortfall in testing or training capability dictates the need for the item. Annotate classified shortfall information to show the document(s) from which the shortfall was derived. Identify specific tests, materiel systems, or technologies for which no testing/ training capability exists. Briefly discuss the impact if the project is not pursued.

4. Capabilities Required. Identify performance (operational effectiveness and suitability) capabilities and characteristics required. State in operational terms and prioritize if possible. Specify each performance parameter in terms of minimum acceptable value (threshold) required to satisfy the mission need and a performance objective. The objective should represent a measureable, beneficial increase in capability or operations and support above the threshold.

a. System Performance. Include system performance parameters such as range, accuracy, payload, speed, mission reliability, etc. Describe mission scenarios (wartime and peacetime, if different) in terms of mission profiles, employment tactics, and environmental conditions (all inclusive: natural and man-made, e.g., weather, countermeasures, ocean acoustics, etc.).

Figure 19-13. Operational Requirements Document

Fig 19-13-2

Description will include the type of data that the instrumentation system will collect, monitor, analyze, and/or control and specify the associated accuracy tolerances as bands of performance. Description will include the essential characteristics, capabilities, or components to be included in a target or threat simulator to provide the required level of fidelity.

b. Logistics and Readiness. Include measures for mission-capable rate, operational availability, frequency and duration of preventive or scheduled maintenance actions, etc. Describe in terms of mission requirements considering both wartime and peacetime logistics operations. Identify combat support requirements including battle damage repair capability, mobility requirements, expected maintenance manpower and skill levels, and surge and mobilization objectives and capabilities.

c. Critical System Characteristics. Address electronic counter-countermeasures (ECCM) and Wartime Reserve Modes (WARM) requirements; conventional, initial nuclear weapons effects, and nuclear, biological, and chemical contamination (NBCC) survivability; natural environmental factors (such as climate, terrain, and oceanographic factors); and electromagnetic compatibility and frequency spectrum assignment for systems operating in the electromagnetic spectrum. Define the expected mission capability (e.g., full, percent degraded, etc.) in the various environments. Include applicable safety parameters such as those related to system, nuclear, explosive, and flight safety. Identify communications, information, and physical and operational security needs.

Also included should be measures to be taken to harden against induced environmental factors such as shock and vibration, normal contaminants, directed energy, smoke aerosols, obscurants, military operations in urban terrain, etc.

5. Integrated Logistics Support (ILS). Establish organizational, intermediate, and depot level support objectives for initial and full operational capability.

a. Maintenance Planning. Identify maintenance tasks to be accomplished and time phasing for depot maintenance, including programmed depot maintenance and surveillance inspections such as

Figure 19-13. Operational Requirements Document

Fig 19-13-3

nuclear hardness and structural integrity. Describe the planning approach for contract versus organic repair.

b. Support Equipment. Define the standard support equipment used by the system. Describe the fault isolation capabilities desired of automatic test equipment at all levels, expressed in terms of realistic and affordable possibilities and confidence levels.

c. Human Systems Integration. Briefly describe the operational and maintenance training concept (pipeline, training devices, embedded training/onboard training, interactive courseware). Identify manpower, personnel, and training constraints. Establish objectives and thresholds if applicable for manpower (force structure and end strength), personnel (numerical and skill level), training, and safety. Specify manpower and training methodologies to be used (e.g., HARDMAN Comparability Methodology).

d. Computer Resources. Identify computer resource constraints (examples include language, computer, data base, architecture, or interoperability constraints). Address all mission critical and support computer resources, including automated test equipment. Describe the capabilities desired for integrated computer resources support. Identify any unique user interface requirements, documentation of needs, and special software certifications.

e. Other Logistics Considerations. Describe the provisioning strategy for the system. Specify any unique facility or shelter requirements. Identify special packaging, handling, and transportation considerations. Define unique data requirements such as engineering data for depot support and technical orders for the system and depot.

6. Infrastructure Support and Interoperability. Discuss interfacing systems (at the system/subsystem, platform, and force levels), specifically those related to command, control, communications, and intelligence (C3I), transportation and basing, and standardization and interoperability. Identify companion Operational Requirements Documents and other Services that may have similar requirements. Assign a joint potential designation (joint, joint interest, independent).

a. Command, Control, Communications, and Intelligence. Describe how the system will be integrated into command, control, communication, and intelligence architecture that is forecast to exist at the time the system will be fielded. Include data requirements (data, voice, video), computer network support, and

Figure 19-13. Operational Requirements Document

Fig 19-13-4

anti-jam requirements. Identify unique intelligence information requirements, including intelligence interfaces, communications, and data base support pertaining to target and mission planning activities, threat data, etc.

b. Transportation and Basing. Describe how the system will be moved either to or within the theater. Identify any lift constraints. Detail the basing and associated facilities available for training locations and main and forward operating bases.

ITTS will normally be transported by truck or rail, with the exception of aircraft, which will normally be self-deploying. Transportability by C-141/C-17 aircraft will not be routinely included as a mandatory transportability parameter. Discussion will identify which test organizations, centers, ranges, etc. will receive the item and the quantity to be received.

c. Standardization, Interoperability, and Commonality. Describe considerations for joint use, NATO cross-servicing, etc. Identify procedural and technical interfaces, and communications, protocols, and standards required to be incorporated to ensure interoperability with other Service, joint Service, and Allied systems. Address energy standardization and efficiency needs for both fuels and electrical power as applicable.

Discussion will also include: compatibility and interface requirements for existing major range and test facility instrumentation and communication systems; compatibility requirements with operational characteristics of the materiel systems on which an instrumentation item will be used, e.g., camouflage, aerodynamics, radio/electronic signature, etc.

d. Mapping, Charting, and Geodesy Support. Identify cartographic materials, digital topographic data, and geodetic data needed for system employment. Where possible, Defense Mapping Agency standard military data will be used.

e. Environmental Support. Identify the standard and unique weather, oceanographic, and astrogeophysical support required. Include data accuracy and forecast requirements.

Figure 19-13. Operational Requirements Document

Fig 19-13-5

Discussion will also include environmental quality control - means of protecting the environment from the operational characteristics of the item.

7. Force Structure. Estimate the number of systems or subsystems needed, including spares and training units. Identify the platforms and quantities of these platforms (including other Services' or Government agencies' if appropriate) that will employ the systems or subsystems being developed and procured to satisfy this Operational Requirements Document.

8. Schedule Considerations. Define what actions, when complete, will constitute attainment of Initial and Full Operational Capability (leave flexible for revision as the program is progressively defined and trade-off studies are completed). Clearly specify the operational capability or level of performance necessary to declare Initial and Full Operational Capability. Include the number of operational systems, operational and support personnel, facilities, and organizational, intermediate, and depot support elements that must be in place. If availability in a specific time frame is important, specify an objective for initial operational capability. Describe the impact if this objective is not achieved and identify a window of acceptability if appropriate.

This subparagraph will be titled "**Schedule/Cost Considerations**" for ITTS systems. Included will be subparagraphs addressing:

a. Risk Assessment. Evaluate the risk associated with availability of both intelligence information/data, if appropriate, and technology.

b. Schedule. Include, as a minimum, outline baseline planning for: Threat Definition Document (TDD), if appropriate; Preliminary Design Review (PDR); Design Specification Review (DSR); development start; Critical Design Review (CDR); acceptance testing; user testing; and Initial Operational Capability (IOC) by fiscal year and quarter.

c. Funding. Identify both development/procurement, by type and quantity per fiscal year, and sustainment cost estimates.

Figure 19-13. Operational Requirements Document

Fig 19-13-6

The following format requirements, applicable to ITTS Operational Requirements Documents, are in addition to those of DoD 5000.2-M.

9. Point of Contact. Include the name, full organizational mailing address, telephone/FAX (AUTOVON/DSN and commercial), and E-mail address of the principal POC for the ORD.

Appendices:

Mission Need Statement (MNS). If applicable, append the MNS upon which the ORD is based.

Threat System Summary - Simulator/Target Mission Analysis. For threat simulators and targets, provide a technical and operational description of the threat system to be replicated. Also include the operational mode summary/mission profile for the simulator/ target, keyed to projected use factors. Data should form the basis for and document required simulator/target quantities referenced in paragraph 7, Force Structure.

Rationale. Provide full rationale for all required system capabilities/characteristics described/addressed in paragraph 4. Use of the term "self-explanatory" is prohibited.

Coordination. List primary major commands, other Services, allied nations, and activities with which coordination of this ORD was effected. Provide full rationale for any nonacceptance of comments received.

Figure 19-13. Operational Requirements Document

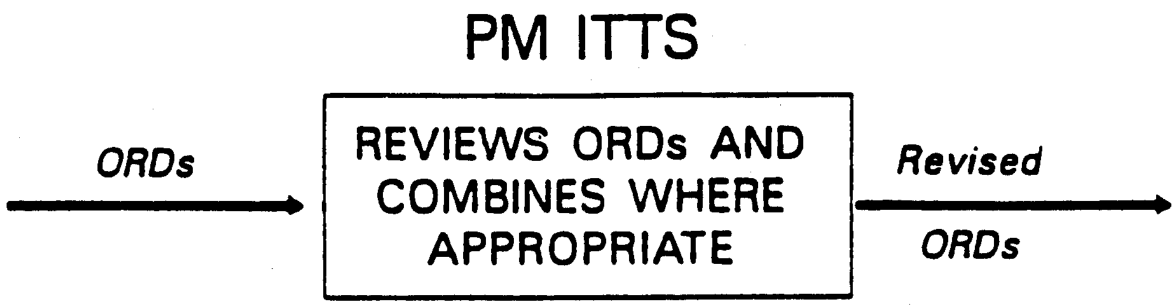
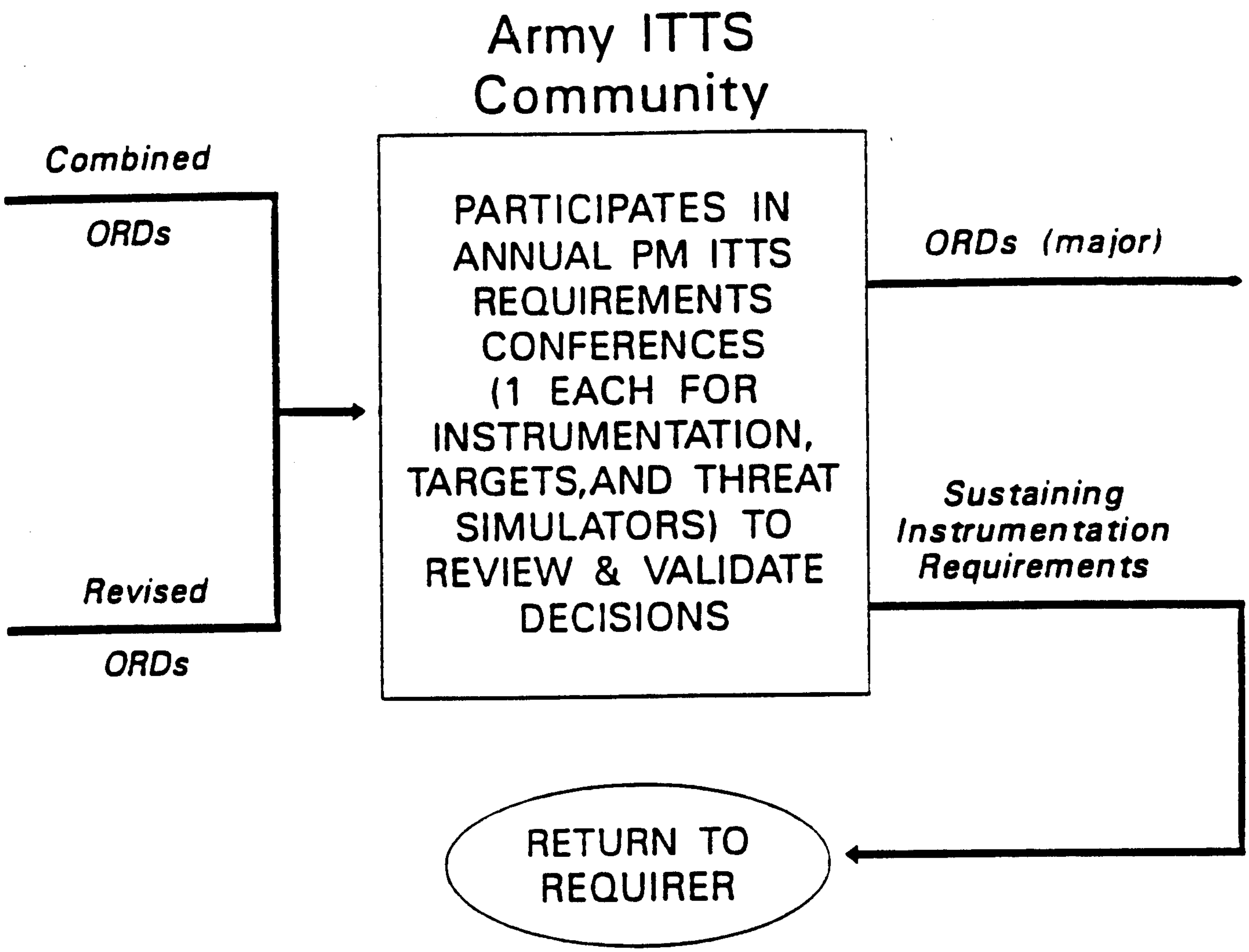

PM ITTS
ORDs
REVIEWS ORDs AND COMBINES WHERE APPROPRIATE
Revised ORDs

FIG 19-14



Army ITTS
Community
Combined
ORDs
PARTICIPATES IN
ANNUAL PM ITTS
REQUIREMENTS
CONFERENCES
(1 EACH FOR
INSTRUMENTATION,
TARGETS,AND THREAT
SIMULATORS) TO
REVIEW & VALIDATE
DECISIONS
ORDs (major)
Sustaining
Instrumentation
Requirements
Revised
ORDs
RETURN TO
REQUIRER

FIG 19-15

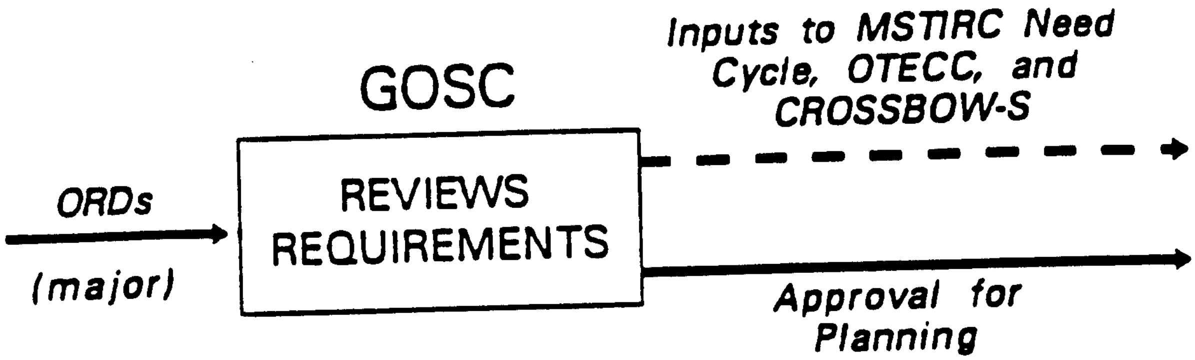

GOSC
Inputs to MSTIRC Need Cycle, OTECC, and CROSSBOW-S
ORDs
(major)
REVIEWS REQUIREMENTS
Approval for Planning

FIG 19-16

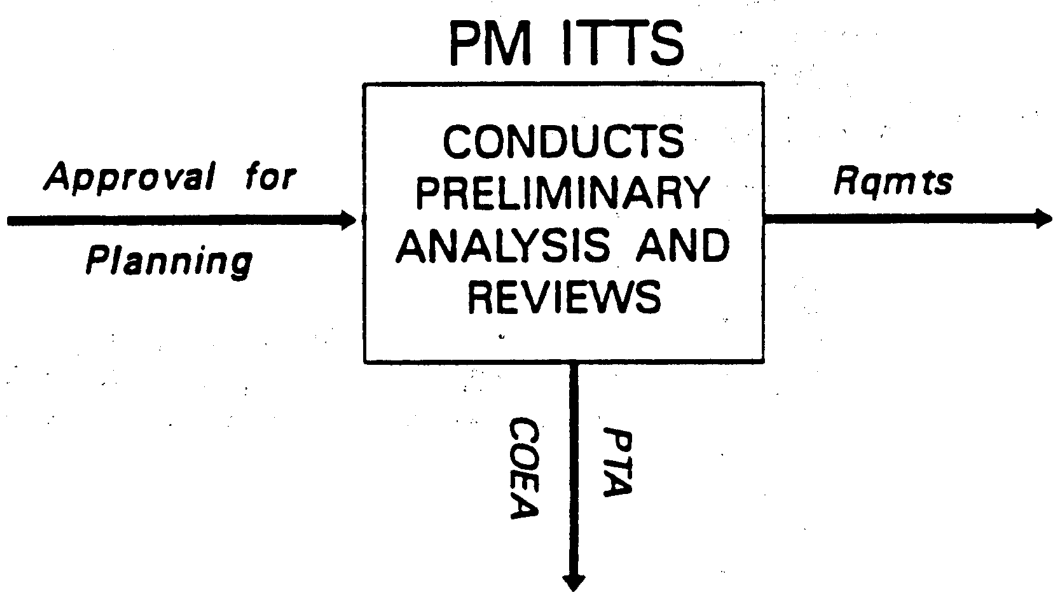

PM ITTS
CONDUCTS PRELIMINARY ANALYSIS AND REVIEWS
Approval for Planning
Rqmts
COEA
PTA

FIG 19-17

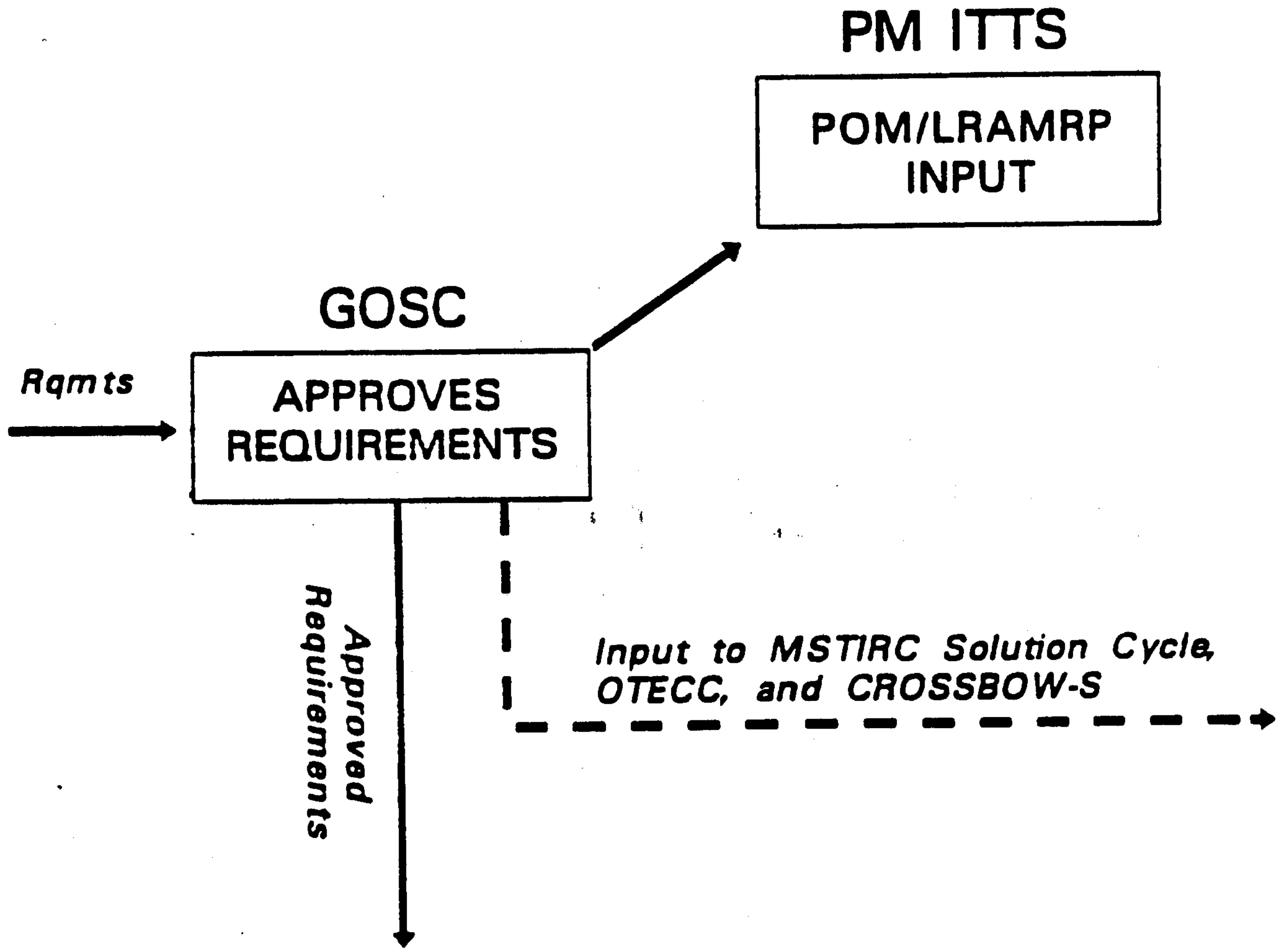

PM ITTS
POM/LRAMRP INPUT
GOSC
Rqmts
APPROVES REQUIREMENTS
Approved Requirements
Input to MSTIRC Solution Cycle, OTECC, and CROSSBOW-S

Fig 19-18

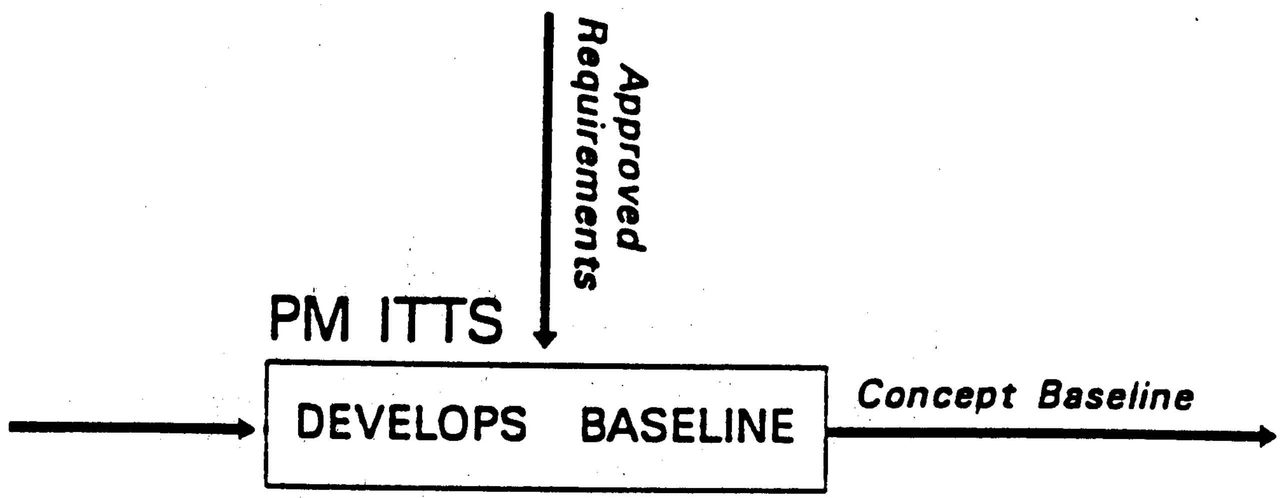

Approved Requirements
PM ITTS
DEVELOPS BASELINE
Concept Baseline

FiG 19-19

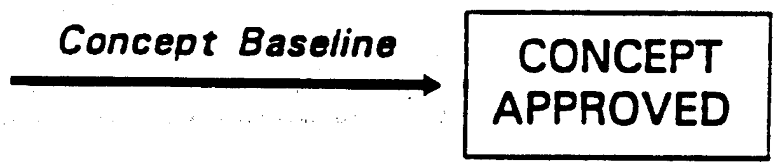


FIG 19-20

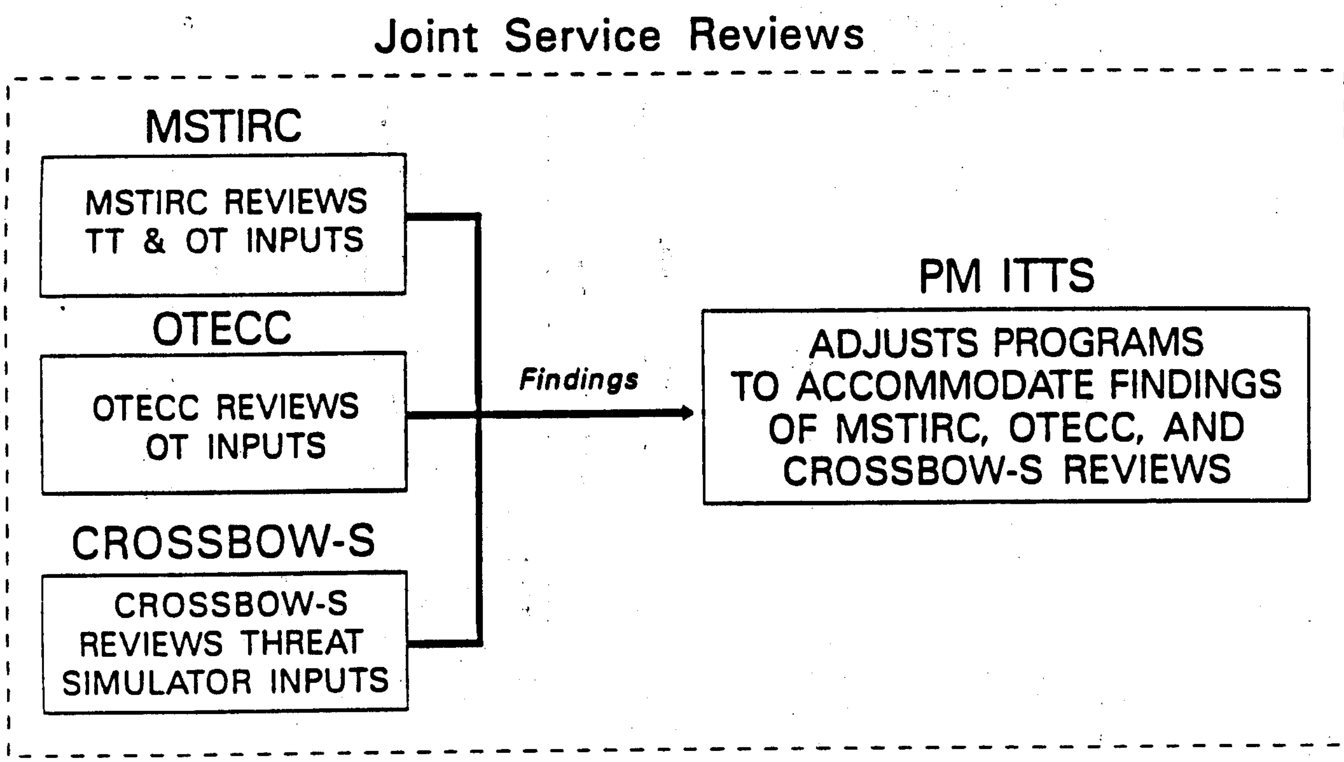

Joint Service Reviews
MSTIRC
MSTIRC REVIEWS TT & OT INPUTS
OTECC
OTECC REVIEWS OT INPUTS
CROSSBOW-S
CROSSBOW-S REVIEWS THREAT SIMULATOR INPUTS
Findings
PM ITTS
ADJUSTS PROGRAMS TO ACCOMMODATE FINDINGS OF MSTIRC, OTECC, AND CROSSBOW-S REVIEWS

FIG 19-21

Requirement Process for Instrumentation, Targets and Threat Simulators

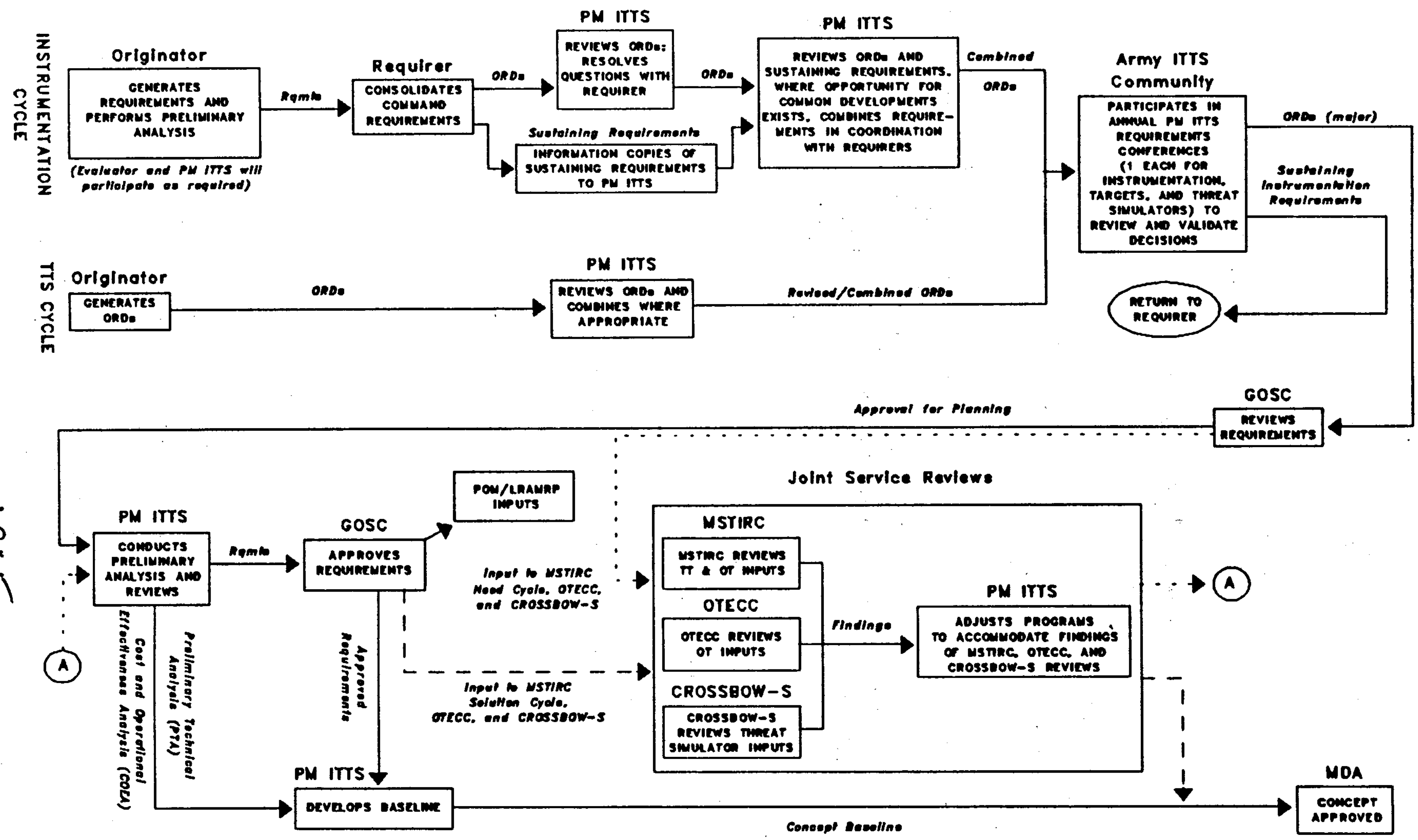


FIGURE 19-22

19-66

DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART TWO

TEST AND EVALUATION MASTER PLAN (TEMP) FORMAT, REVIEW, AND APPROVAL PROCEDURES

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Test and Evaluation Master Plan (TEMP) Format, Review and Approval Procedures

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Part Two

Test and Evaluation Master Plan (TEMP) Format, Review and Approval Procedures

Chapter 1. General Procedures

Section I
Introduction

1-1. General.

All acquisition programs are supported by an acquisition strategy (AS) reflecting a comprehensive and efficient Test and Evaluation (T&E) program. To accomplish this task, each acquisition program/system will have a single Test and Evaluation Master Plan (TEMP). All programs require a TEMP, except, level VI information systems and new drugs and vaccines that fall under Title 21, parts 50, 56 and 312 of the Code of Federal Regulations. (See AR 73-1, paragraph 7.4.b).

1-2. Capstone.

When a program consists of a collection of individual systems performing a common function, using a common capability or performing a collective function, a Capstone TEMP integrating the test and evaluation program planned for the entire system is required. A Capstone TEMP should not exceed 30 pages including pages for figures, tables, matrices, etc. Each individual system TEMP annexed to the Capstone TEMP is to follow the basic content of a TEMP and should not exceed 30 pages.

1-3. Preparation.

The TEMP is prepared by the program manager (understood to include project manager and product manager) in conjunction with principal Test Integration Working Group (TIWG) members and approved by the appropriate TEMP approval authority. When under time and urgency constraints, the PM can prepare a strawman TEMP to be finalized by the TIWG.

a. The TEMP is the basic planning document for all life cycle T&E related to a particular system acquisition and is used by all decision bodies in planning, reviewing, and approving T&E activity. Drafters should therefore remain aware that the TEMP is a planning mechanism required before proceeding to the next acquisition milestone. In addition, the approved TEMP is the basic reference document used by the T&E community to generate detailed test and evaluation plans and to ascertain schedule and resource requirements associated with the T&E program. Since the TEMP charts the T&E course of action during the system acquisition process, all testing which impacts on the program decisions is outlined in the TEMP.

b. The TEMP addresses the T&E to be accomplished in each planned program phase with the next phase addressed in the most detail. When Developmental and Operational Testing are combined, the TEMP will separately address the two different categories of test. Part III, Developmental Test and Evaluation Outline, will detail the developmental test and evaluation portion of the DT/OT test. Part IV, Operational Test & Evaluation Outline, will detail the operational test and evaluation portion of the DT/OT test.

c. The TEMP is a summary document showing who, what, where, when, why, and how the critical technical parameters and critical operational issues will be tested/evaluated. An approved TEMP is required for an Outline Test Plan (OTP) to be included in the Five Year Test Program (FYTP).

d. The basic content of a TEMP should not exceed 30 pages, including pages for figures, tables, matrices, etc. In addition, Appendix A, Bibliography; Appendix B, Acronyms; and Appendix C, Points of Contact, are excluded from the 30-page limit as are any annexes. Their size should be kept to a minimum.

1-4. Format.

Army policy requires that DoD 5000.2-M format be followed for all programs requiring a TEMP. Within this format the level of detail is unique for each program. Tailoring of TEMP contents within this format is particularly encouraged for programs not requiring Army Secretariat or OSD level approval. The level of detail required for any TEMP is directly related to the approved T&E strategy and the complexity of the test and evaluation effort needed to verify attainment of technical performance, technical specifications, objectives, safety, supportability and to support the evaluation/assessment of the operational effectiveness and operational suitability of the system. It is not directly related to the size of the program. The content guidance contained in the following chapters is intended to assist the TIWG organizations and the TEMP approval authority in developing a TEMP that reflects an adequate and efficient test and evaluation program. These content guidelines should not be viewed as a rigid template for all programs.

1-5. COEA Interface.

OSD memorandum, 21 February 1992, Subject: Implementation Guidelines for relating Cost and Operational Effectiveness Analysis (COEA) Measures of Effectiveness (MOEs) to Test and Evaluation, reemphasizes policy contained in DoDI 5000.2 regarding the need to maintain linkage between the COEA and test and evaluation, particularly between the MOEs and the performance parameters which define the military utility of a system. Chapter 3 contains guidance for TEMP Parts I, III and IV implementing this policy.

Section II
Non-Majors

1-6. Tailoring.

Tailoring guidelines for TEMPs not requiring Army Secretariat or OSD approval (generally ACAT III or IV materiel and Class V Information Mission Area (IMA) programs) are addressed throughout this volume.

a. The general format in DoD 5000.2-M must be followed, however, tailoring is allowed to reduce development effort and minimize size.

b. Guidance includes a tailored review and approval process.

(1) Paragraph 2-4 describes a coordination process for obtaining TIWG concurrence that allows use of video teleconference and mail or facsimile coordination to obtain TIWG member signatures.

(2) Paragraph 2-11 describes a unique staffing and approval process.

(3) The revision process described in paragraph 2-14.applies only to TEMPs that are forwarded for Army Secretariat or OSD approval.

c. Guidance for tailoring the contents of materiel system TEMPs includes:

(1) Part I, System Introduction, paragraph (c) Minimum Acceptable Operational Performance Requirements. It is sufficient to reference the Operational Requirements Document (ORD).

(2) Part II, Integrated Test Program Summary. The schedule format in figure 3-9 does not have to be rigidly followed. A program schedule can be used as long as test events are identified. Funding information is optional. TIWG member responsibilities do not have to be described in detail. Referencing the charter is sufficient.

(3) Part III, Developmental Test and Evaluation Outline, d. Live Fire Test and Evaluation. Most ACAT III and IV programs will not undergo formal live fire test unless they meet the definition of a major covered program or major munition as described in Part Five, Live Fire Test and Evaluation Guidelines. For these programs this paragraph is not applicable. This should not be confused with gun firing or armor plate tests, etc, needed to validate the vulnerability/lethality requirements of the system.

Section III
Development

1-7. Input

TEMP input is appropriate test and evaluation information that is deemed necessary to ensure requirements outlined from the ORD are being addressed or have been satisfied. TEMP input is primarily provided by the program manager, developmental tester, developmental evaluator or assessor, operational tester, operational evaluator, combat developer, and logistician. See Part One, Chapter 8 for TIWG composition, roles and functions. Other government and contractor activities may also provide input to the TEMP, when appropriate. All inputs are integrated into the TEMP by the program manager who has primary responsibility for preparation, staffing, and update of the TEMP. The TIWG executes a TEMP coordination sheet that accompanies the TEMP when forwarded for TEMP decision authority approval. A TEMP signature page is executed by the submitter, reviewers, and approval authority.

1-8. OSD T&E Oversight.

The Office, Secretary of Defense (OSD) T&E Oversight list is jointly published on an annual basis by the Director, Operational Test and Evaluation (DOT&E) and the Director, Test and Evaluation (D,T&E), Office of the Under Secretary of Defense (Acquisition). These programs require OSD TEMP approval and forwarding of T&E documentation to OSD. A preliminary TEMP is due to OSD within 90 days after program designation. These preliminary TEMPs will be final TEMPs for programs in the Demonstration-Validation acquisition phase.

1-9. Submission.

Army policy requires that TEMPs submitted to OSD to comply with the milestone documentation submission schedule and be Army approved. DoDI 5000.2 requires programs subject to Defense Acquisition Board (DAB) review to submit the TEMP to OSD 45 days prior to the DAB committee review. Programs on the OSD T&E Oversight list that are subject only to internal Army review i.e., ACAT 1C, II, III and IV, must submit the TEMP to OSD 45 days prior to the Milestone review. An additional 20 days are needed for HQDA and AMC staffing and DUSA(OR) approval prior to submission to OSD.

Section IV
TEMP Update

1-10. OSD T&E Oversight.

For OSD T&E Oversight programs, when development is complete and critical operational issues are satisfactorily resolved, including the verification of deficiency correction, a TEMP update is no

longer required. A request to delete the program from the OSD T&E Oversight list should be prepared by the PM and forwarded through the PEO (or Developing Agency if not a PEO managed program) to The U.S. Army Test and Evaluation Management Agency (TEMA) for forwarding to the Director, Test and Evaluation (D,T&E) and Director, Operational Test and Evaluation (D,OT&E) for approval. The request must be coordinated with Headquarters, Training and Doctrine Command (TRADOC), Operational Test and Evaluation Command (OPTEC) and Army Materiel Systems Analysis Activity (AMSAA) or the Test and Evaluation Command (TECOM), if a TECOM assessed program, as the developmental independent evaluator/assessor and AMSAA as the logistician, before forwarding to TEMA.

1-11. Update deferral

For programs not on the OSD T&E Oversight list, when development is complete and critical operational issues are satisfactorily resolved, including the verification of deficiency correction, a TEMP update is no longer required. A request to defer further update should be prepared by the PM or designated system manager, coordinated with the TIWG and approved by the TEMP approval authority. Approval should be made a matter of record. Programs possessing the following attributes may no longer require a TEMP update to be submitted:

a. Fully deployed system with no operationally significant product improvements or block modification efforts.

b. Full production ongoing, fielding initiated with no significant deficiencies observed in production qualification test results.

c. Partially fielded system in early production phase having successfully accomplished all developmental test (DT) and operational test (OT) objectives.

d. Programs for which planned T&E is only a part of routine aging and surveillance testing, service life monitoring, or tactics development.

e. Programs for which no further OT or live fire test (LFT) is required by the Army, Joint Chiefs of Staff (JCS), or the OSD.

f. Programs for which future testing (e.g., product improvements or block upgrades) has been incorporated in a separate TEMP (e.g., an upgrade TEMP).

Section V
Submission

1-12. Accompanying Documents.

For all TEMPs requiring OSD approval, three (3) copies of the approved (or draft if not yet approved) Mission Need Statement (MNS), Operational Requirements Document (ORD) and validated System Threat Assessment Report (STAR) will be forwarded with the TEMP. (For Information Mission Area systems the document(s) to be forwarded are the MNS, the functional description, when requested, and the STAR if prepared for the system). If these support documents are final and have not changed since the last TEMP submission, a statement will accompany the TEMP attesting to that fact; copies of the documents need not be forwarded. The statement should cite the date, version and or change number for the most current documents.

1-13. Referenced Documents.

All documents referenced in the TEMP must be available for submission to Headquarters, Department of the Army (HQDA) or OSD on request.

1-14. Preliminary TEMP.

For preliminary TEMPs, i.e., those submitted to support Milestone I, information not yet available should be so noted and the date or event identified when information will be known. The TEMP should be updated when the information is available.

Chapter 2
Preparation, Review and Approval Process

Section I
Introduction.

2-1. General

Development of the TEMP begins with the establishment and chartering of the Test Integration Working Group (TIWG) by the materiel developer (for the initial TEMP) during the Concept Exploration and Definition phase. The TIWG charter will identify the role and responsibilities of all agencies participating in test and evaluation. See AR 73-1 and Part One, Chapter 8 for details, an example of specific responsibilities and a sample of the TIWG charter. These TIWG specific responsibilities are aligned with the various parts of the TEMP as shown in Figure 2-1.

TEMP	PM	CD/FP	TI	IDE	DT	IOE	OT	LOG
Part I System Introduction								
a. Mission Description	P	S						
b. System Threat Assessment	P		S					
c. Min Acceptable Operational Performance Requirements		P						S
d. System Description	P	S						
e. Critical Technical Parameters	S	S		P		S		S
Part II Integrated Test Program Summary								
a. Integrated Test Program Schedule	P			S	S	S	S	S
b. Management	P	S		S	S	S	S	S
Part III Developmental Test and Evaluation Outline								
a. Developmental Test and Evaluation Overview	S			P	S			S
b. Developmental Test and Evaluation to Date	S			P	S			S
c. Future Developmental Test and Evaluation	S			P	S			S
d. Live Fire Test and Evaluation	S			P	S			
Part IV Operational Test and Evaluation Outline								
a. Operational Test and Evaluation Overview						P	S	S
b. Critical Operational Issues		P				S		
c. Operational Test and Evaluation to Date		S				P	S	
d. Future Operational Test and Evaluation		S				P	S	S
Part V Test and Evaluation Resource Summary								
a. Test Articles	S			P	S	P	S	S
b. Test Sites and Instrumentation	P	S		S	P	S	P	S
c. Test Support	S		S		P		P	S
d. Threat Systems/Simulators	S		S		S	S	P	
e. Test Targets and Expendables	P		S		P		P	
f. Operational Force Test Support				S		S	P	
g. Simulations, Models and Testbeds				P	S	P	S	
h. Special Requirements	S			P	S	P	S	
i. T&E Funding Requirements	P			S	P	P	S	
j. Manpower / Personnel Training		P			P		P	S
Appendix A Bibliography	P	S	S	S	S	S	S	S
Appendix B Acronyms	P	S	S	S	S	S	S	S
Appendix C Points of Contact	P	S	S	S	S	S	S	S
Annexes / Attachments	P							

Note: P: Principal Responsibility; S: Support Responsibility
PM: Program Manager; CD/FP: Combat Developer/Functional Proponent
IDE: Independent Developmental Evaluator; DT: Developmental Tester; TI: Threat Integrator
IOE: Independent Operational Evaluator; OT: Operational Tester; LOG: Logistician

Figure 2-1 TEMP Preparation Responsibilities Matrix

2-2. Principal Responsibilities.

The program manager ultimately has the final responsibility to produce the TEMP. The ideal method to develop a TEMP is for a concurrent TEMP development by the program manager, the developmental evaluator, the developmental tester, the operational evaluator, the operational tester and the combat developer. On small programs, or programs with tight schedules, it is often necessary for the program manager to develop the first draft strawman TEMP with minimal or no input from other agencies. That input will come during the review cycle when the TEMP is staffed for concurrences. The responsibilities to maintain TEMP currency and the interface between TIWG members by TEMP paragraph are generally as shown in Figure 2-1.

a. Program Manager: prepare Part I, System Introduction, Part II, Integrated Test Program Summary, portions of Part III, Developmental Test and Evaluation Outline (documenting tests that provide information directly to the sponsor, e.g. contractor tests) and Part V, Test and Evaluation Resource Summary.

b. Combat Developer: provide the Minimum Acceptable Operational Performance Requirements, Part I, System Introduction and input to Part V, T&E Resource Summary, in particular, Manpower/Personnel Training Requirements and provides the Critical Operational Issues and Criteria (COIC), Part IV, Operational Test and Evaluation Outline.

c. Independent Developmental Evaluator/Assessor and Developmental Tester: provide Part III, Developmental Test and Evaluation Outline and input to Part V, T&E Resource Summary.

d. Independent Operational Evaluator and Operational Tester: provide Part IV, Operational Test and Evaluation Outline and input to Part V, T&E Resources Summary.

2-3. TIWG Responsibilities.

The program manager has overall responsibility to develop the TEMP to include establishing the schedule for development. An early TIWG meeting should be held, possibly in conjunction with a review of the draft Operational Requirements Document (ORD)/IMA systems requirements document, to familiarize TIWG members with the preliminary system requirements. This meeting is used to assist the program manager in developing the test and evaluation strategy to be incorporated into the acquisition strategy and to insure that all appropriate TIWG members are identified. The program manager will provide the available requirements documentation, draft acquisition strategy, with the T&E strategy incorporated and other pertinent program documentation at this time. TIWG members should be tasked to draft their respective portions of the TEMP. The initial draft submission should take no more than 30 calendar days for input to the program manager.

a. The TEMP input received from the TIWG members is assembled by the program manager and the consolidated document is sent for review to all TIWG members within 15 calendar days. An additional 30 calendar day period is allowed for the TIWG member to staff the TEMP within the members organization to ensure complete organizational concurrence. Issues identified during organization review and recommended changes should be forwarded to the program manager (TIWG chair) and other TIWG members prior to the TIWG. Issues should be discussed and resolved at the TIWG. Electronic coordination/review is encouraged to help meet the tight review times. The Test and Evaluation Community Network (TECNET) and/or local area nets connected via the Defense Data Network (DDN) are available to accomplish the coordination.

b. TIWG members represent their organization and shall have the authority to concur in the TEMP for their organization. They also have an obligation to participate in the TIWG meeting unless the agenda does not include topics where they have a direct interest.

c. It is particularly critical for TIWG members to inform the PM well in advance of the TIWG of any issue(s) which would prevent concurrence in the TEMP. There is little value in convening a TIWG for the purpose of concurring in a TEMP, if the TIWG member cannot concur because of issue(s) with its content.

d. Issues not resolved to the satisfaction of the TIWG members are elevated through their chain of command. If not resolved, the issues are brought to the attention of the DUSA(OR) for resolution. This applies to systems both materiel and IMA in all ACATs and classes.

e. The TEMP development and TIWG coordination process is depicted in figure 2-2.

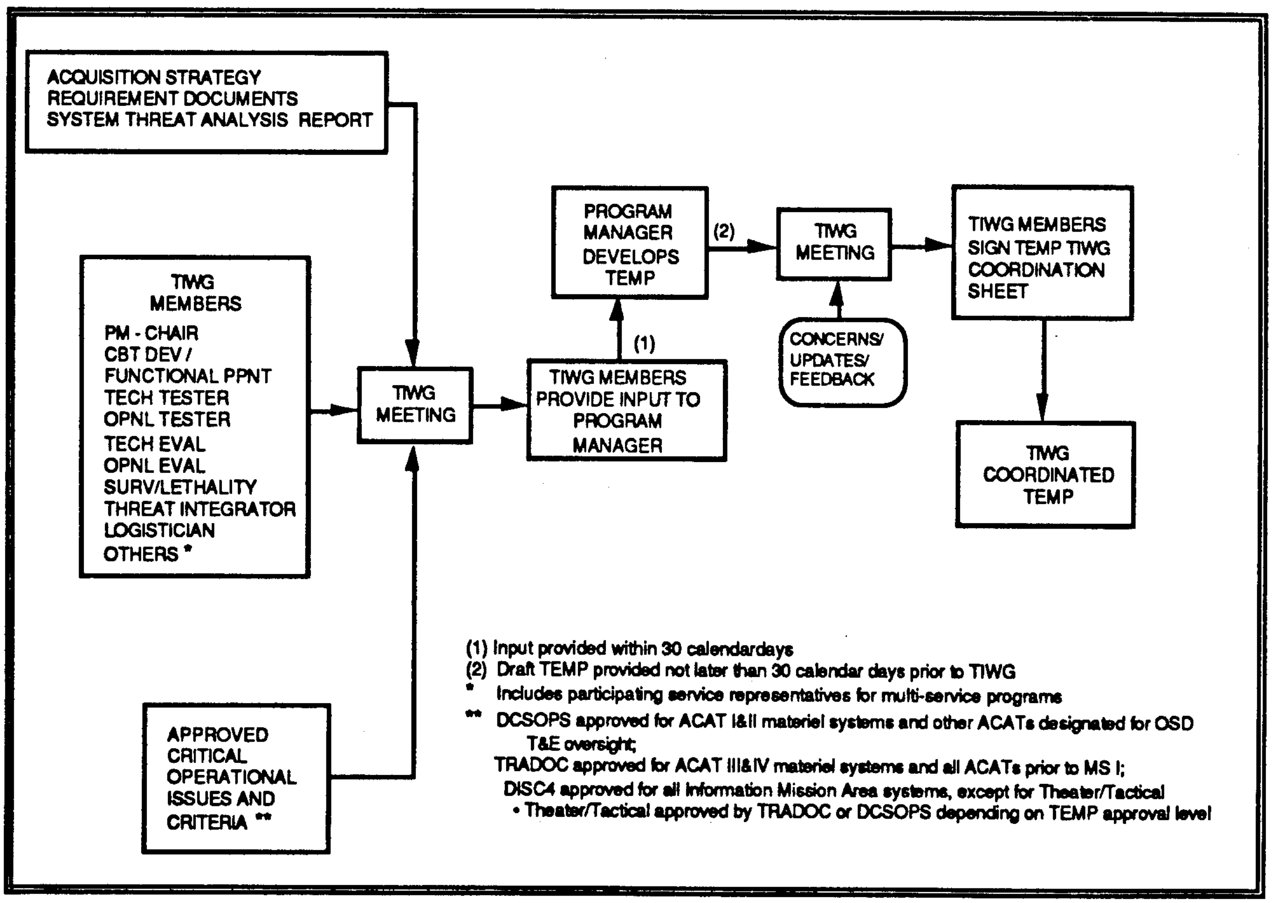

Figure 2-2 TEMP Preparation/TIWG Coordination Process

2-4. TIWG Meeting Alternatives.

It is not necessary to conduct a TIWG meeting only to obtain TEMP concurrence signatures. The complexity and scope of T&E for ACAT I and II programs often warrants the travel time and effort associated with a TIWG meeting. ACAT III and IV level and IMA Class V programs may forgo the convening of a TIWG meeting and conduct TIWG business by video teleconference with TEMP coordination via mail. The complexity of the T&E program should dictate the TIWG level of effort and the need for face to face discussions. Means available to facilitate discussion and coordination are:

(1) Video teleconference (VTC). Normally limited to 1-2 hours of broadcast time. Good for disseminating information and reviewing the status of comments requiring changes to the TEMP. Not suitable for page by page TEMP review.

(2) Mail and facsimile coordination. A viable way to obtain TEMP concurrence when the T&E program is straight forward and non-controversial. A concerted effort is required by all TIWG members to forward concurrences to the PM.

Section II
Review and Approval Process.

2-5. General.

Once the TEMP has the concurrence of all the TIWG members, the TEMP is submitted for principal signatory review and approval. This review and approval process differs depending on TEMP approval authority. Changes required to the TEMP as a result of review must be restaffed with the TIWG and other principal signatories. Restaffing time must be held to a minimum, i.e., no more than 15 calendar days. (See paragraph 2-5.)

2-6. Acquisition Category I (ACAT I) and OSD T&E Oversight materiel programs.

a. The program manager signs in the "submitted by" signature block and forwards the TEMP to the PEO (developing agency, if not under PEO structure) for concurrence.

b. The PEO or developing agency forwards the TEMP <u>concurrently</u> to HQ TRADOC and OPTEC for concurrence. This coordination process should take no more than 30 calendar days and supplements the coordination accomplished at the TIWG level.

c. The PEO forwards an original and 21 copies of the fully coordinated TEMP to the Test and Evaluation Management Agency (TEMA) for HQDA staffing and approval by the DUSA(OR). One copy of the MNS, STAR and ORD should be forwarded or a statement of currency if documents were previously submitted and are still

current. This coordination process should take no more than 20 calendar days.

d. Upon Army approval, the PEO provides an additional 15 copies to TEMA for forwarding by the DUSA(OR) to the D,T&E for review and OSD approval. Also provide two copies of the MNS, STAR and ORD or statement of currency if documents were previously submitted with the TEMP to OSD and are still current.

e. A TEMP is approved when signed by the DOT&E and D,T&E. The OSD objective is to provide formal approval or comments/suggested TEMP modifications within 45 calendar days of receipt.

f. The OSD approval memorandum and signed TEMP signature page are forwarded by TEMA to the PEO or developing agency for inclusion in the TEMP and distribution.

g. This process is reflected at figure 2-3.

h. The signature page format is shown in figure 3-1.

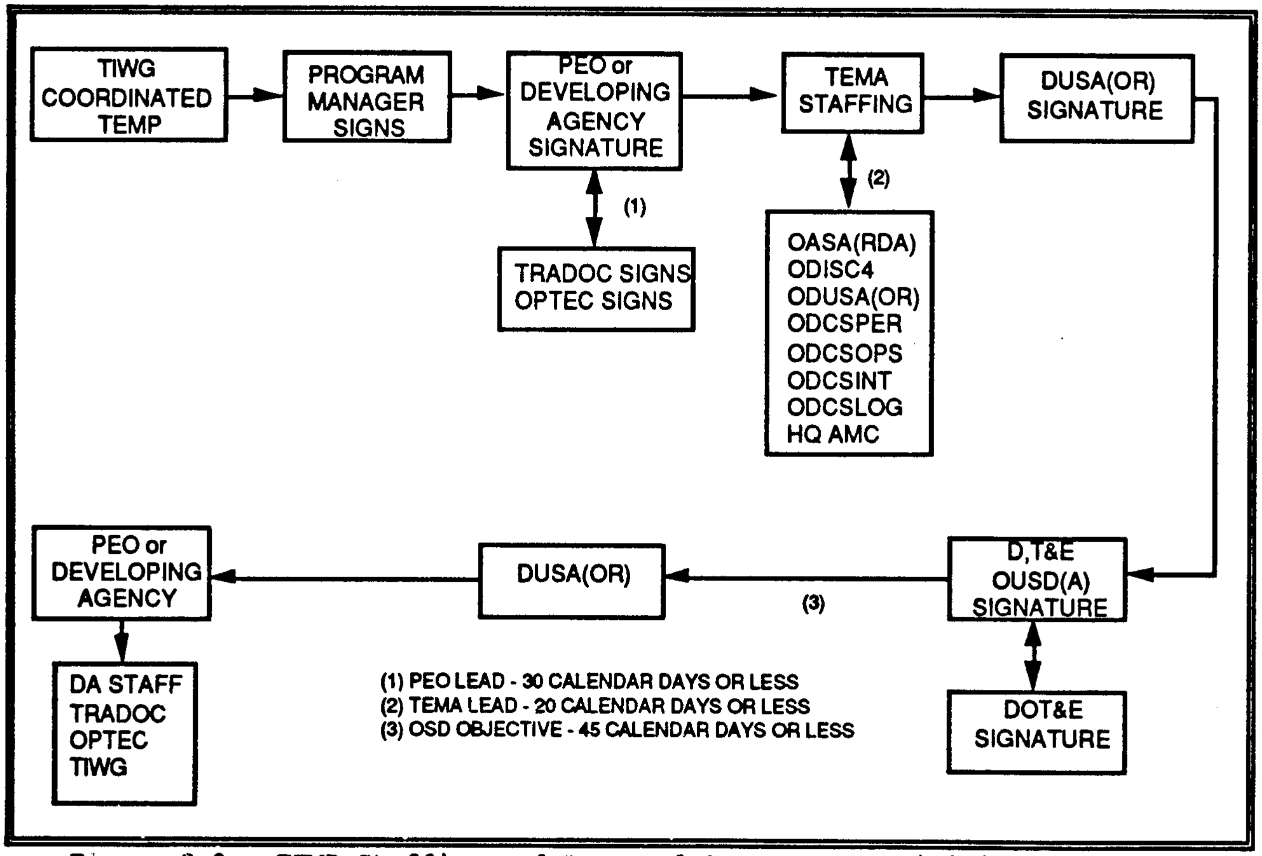

Figure 2-3. TEMP Staffing and Approval Process, Acquisition Category I & OSD Oversight Materiel Programs

2-7. Multiservice ACAT I and OSD T&E Oversight materiel programs for which the Army has lead.

a. The program manager signs in the "submitted by" signature block and forwards the TEMP to the PEO (developing agency, if not under PEO structure) for concurrence.

b. The PEO or developing agency forwards the TEMP concurrently to HQ TRADOC, OPTEC and the participating service operational test agencies and participating service PEO or Developing Agency and User Representative for concurrence. This coordination process should take no more than 30 calendar days and supplements the coordination accomplished at the TIWG level.

c. The PEO or developing agency provides an original and 21 copies plus one for each participating service of the TEMP to TEMA for HQDA staffing and other service approval. Also one copy of the MNS, STAR and ORD or a statement of currency if documents were previously submitted and are still current. This coordination process should be accomplished within 20 calendar days. The TEMP is then submitted for approval by the DUSA(OR).

d. Upon approval, the PEO or developing agency provides 15 copies of the approved TEMP to TEMA for forwarding by the DUSA(OR) to the D,T&E for review and OSD approval. Also provide two copies of the MNS, STAR and ORD or a statement of currency if documents were previously submitted with the TEMP to OSD and are still current.

e. The TEMP is approved when signed by the DOT&E and D,T&E. The OSD objective is to provide formal approval or comments/suggested TEMP modifications within 45 calendar days of receipt. Each participating service receives a copy of the OSD memorandum.

f. The OSD approval memorandum and signed TEMP signature page are forwarded by the DUSA(OR) to the PEO for inclusion in the TEMP and distribution.

g. This process is reflected at figure 2-4.

h. The signature page format is shown in figure 3-2. If there is more than one participating service or agency, a separate Signature Page for each service/agency should be prepared. The Signature Page should include the signature block for the Service/Agency PEO, the user representative, the Operational Test Agency and the Service/Agency TEMP approval official. The TEMP approval official for the Air Force is the Assistant Secretary of the Air Force (Acquisition) and for the Navy it is the Assistant Secretary of the Navy (Research, Development and Acquisition).

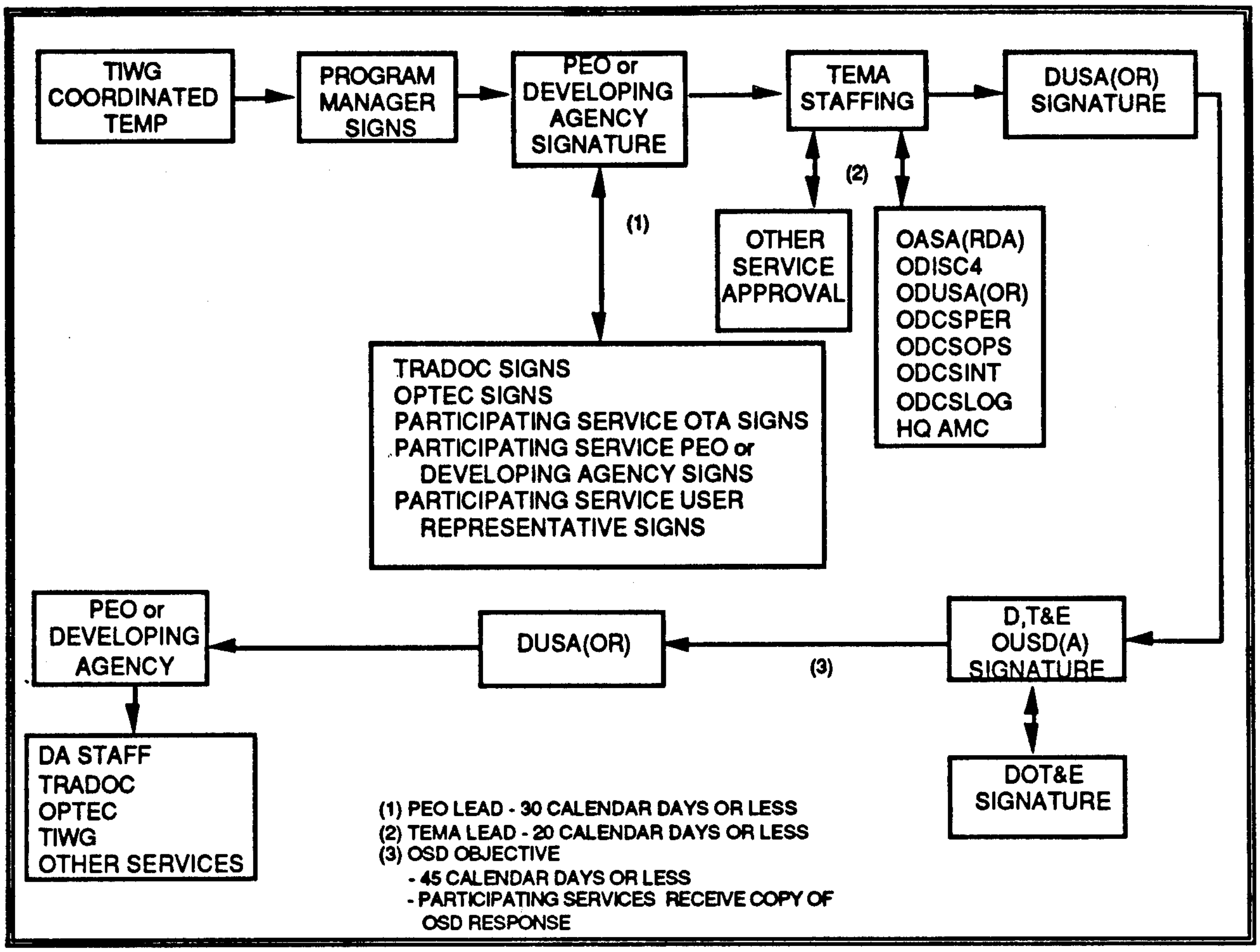

Figure 2-4. TEMP Staffing and Approval Process, Acquisition Category I & OSD T&E Oversight Multiservice Materiel Programs, Army Lead

2-8. Multiservice ACAT I and OSD T&E Oversight materiel programs for which the Army is a participant.

a. The TEMP is prepared according to Lead Service / Agency procedures. Army unique COICs can be provided for inclusion as an annex to the TEMP when required per DoD 5000.2-M.

b. The lead service program manager forwards the TIWG (or equivalent) concurred in TEMP to the lead service PEO for concurrence. The lead service PEO sends the TEMP to the Army PEO or Developing Agency for signature and to secure OPTEC and HQ TRADOC concurrence on the signature page. For those multi-service programs where a separate Army TIWG is convened and TEMP coordination is documented on a TIWG Coordination Sheet, the responsible Army PEO or PM should forward the TIWG concurrence to TEMA to support HQDA review and approval by the DUSA(OR).

c. The lead service provides the TEMP to TEMA for HQDA staffing and approval by the DUSA(OR). This coordination process must be accomplished within 20 calendar days.

d. The Army approved TEMP is returned by the DUSA(OR) to the lead service.

e. The TEMP is forwarded by the lead service acquisition executive to the D,T&E for review and OSD approval.

f. The OSD approved TEMP is distributed by the lead service PEO. Each participating service receives a copy of the OSD memorandum.

g. This process is reflected at figure 2-5.

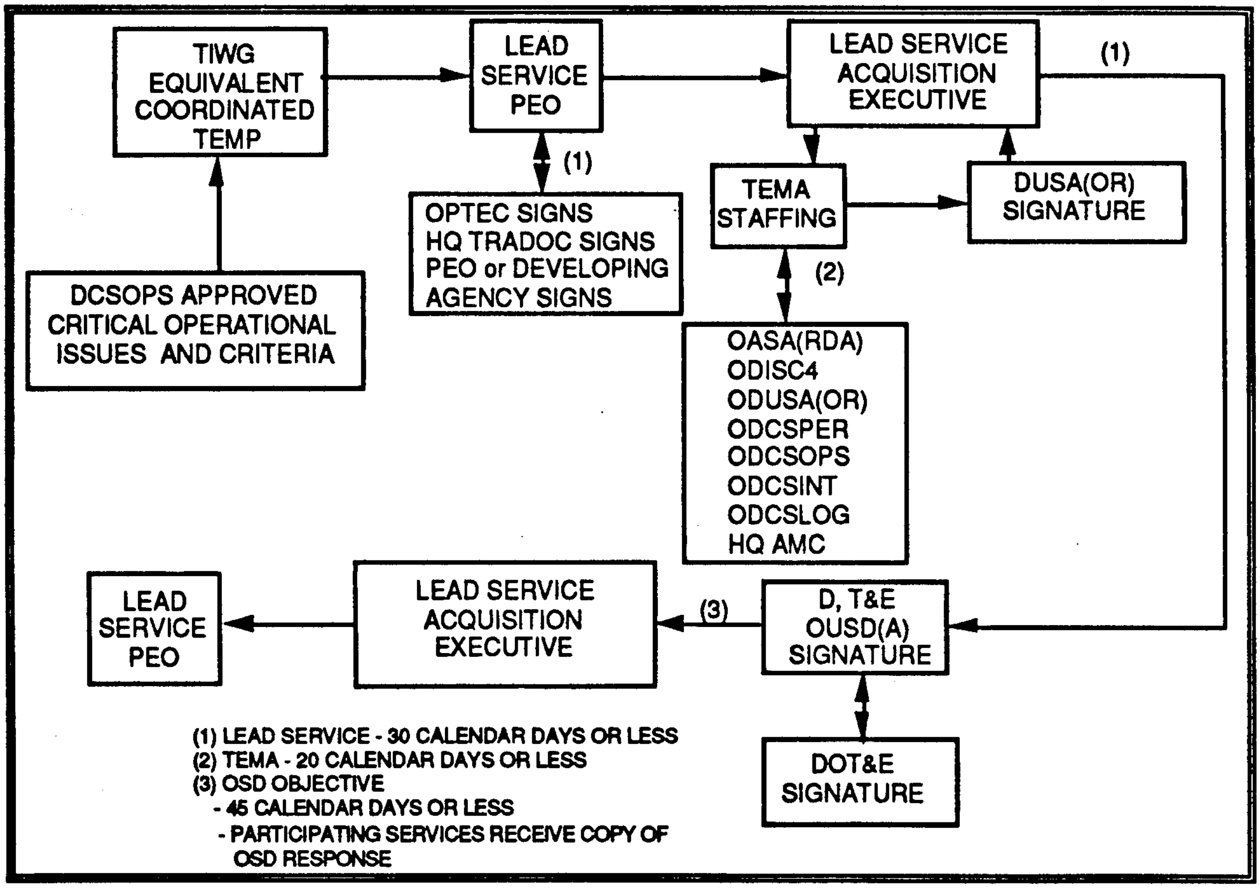

Figure 2-5. TEMP Staffing and Approval Process, Acquisition Category I & OSD T&E Oversight Multiservice Programs, Army Participating

2-9. Acquisition Category II (ACAT II) and Army Special Interest materiel programs.

a. The program manager signs in the "submitted by" signature block and forwards the TEMP to the PEO (developing agency, if not under PEO structure) for concurrence.

b. The PEO or developing agency forwards the TEMP concurrently to HQ TRADOC and OPTEC for concurrence. This coordination process should take no more than 30 calendar days and supplements the coordination accomplished at the TIWG level.

c. The PEO or developing agency provides an original and 21 copies of the TEMP to the TEMA for HQDA staffing and approval by the DUSA(OR).

d. The Army approved TEMP is returned to the PEO or developing agency for distribution.

e. This process is reflected at figure 2-6.

f. The signature page format is shown in figure 3-3.

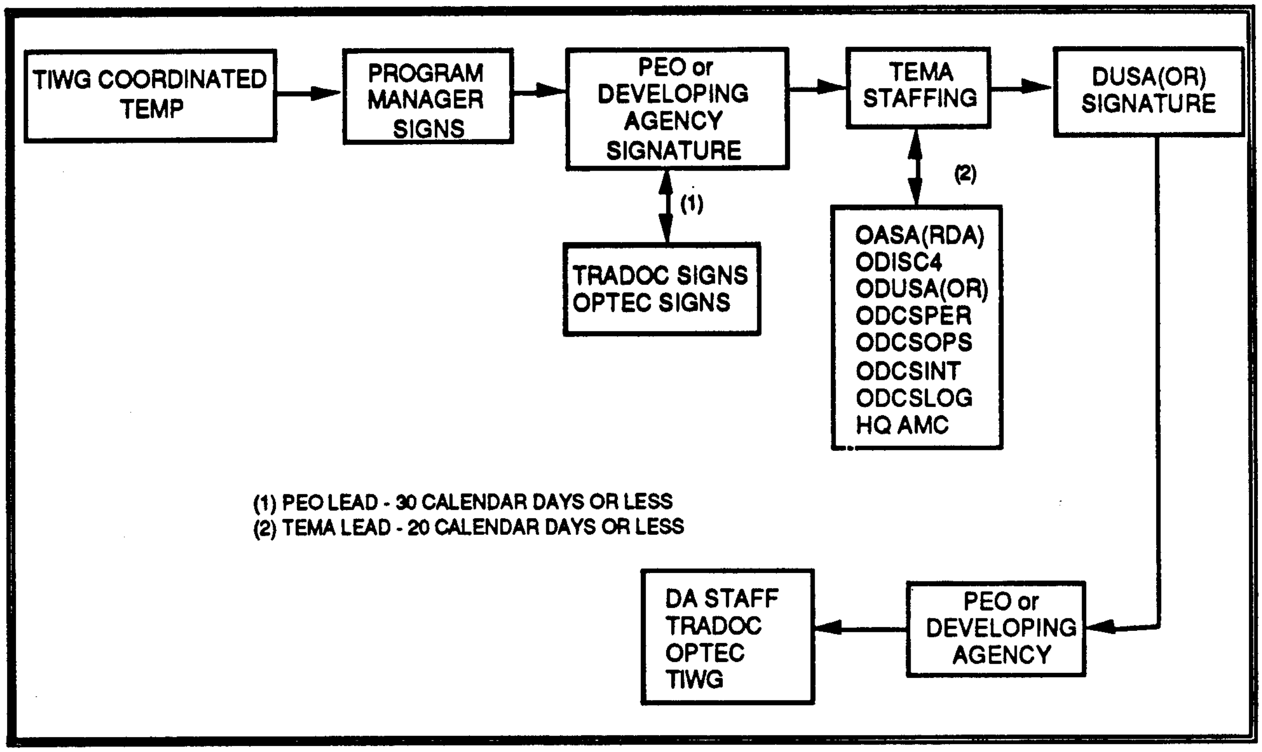

Figure 2-6. TEMP Staffing and Approval Process, Acquisition Category II and Army Special Interest Materiel Programs

2-10. Multiservice ACAT II programs for which the Army has the lead.

a. The program manager signs in the "submitted by" signature block and forwards the TEMP to the PEO (developing agency, if not under PEO structure) for concurrence.

b. The PEO or developing agency forwards the TEMP concurrently to HQ TRADOC, OPTEC and the participating service operational test agencies, participating service PEO or Developing

Agency and User Representative for concurrence. This coordination process should take no more than 30 calendar days and supplements the coordination accomplished at the TIWG level.

c. The PEO or developing agency provides an original and 21 copies, plus one for each participating service, of the TEMP to TEMA for HQDA staffing and other service approval. The TEMP is then submitted for approval by the DUSA(OR).

d. The DUSA(OR) approved TEMP is returned to the PEO or developing agency for distribution.

e. This process is reflected at figure 2-7.

f. The signature page format is shown at figure 3-4.

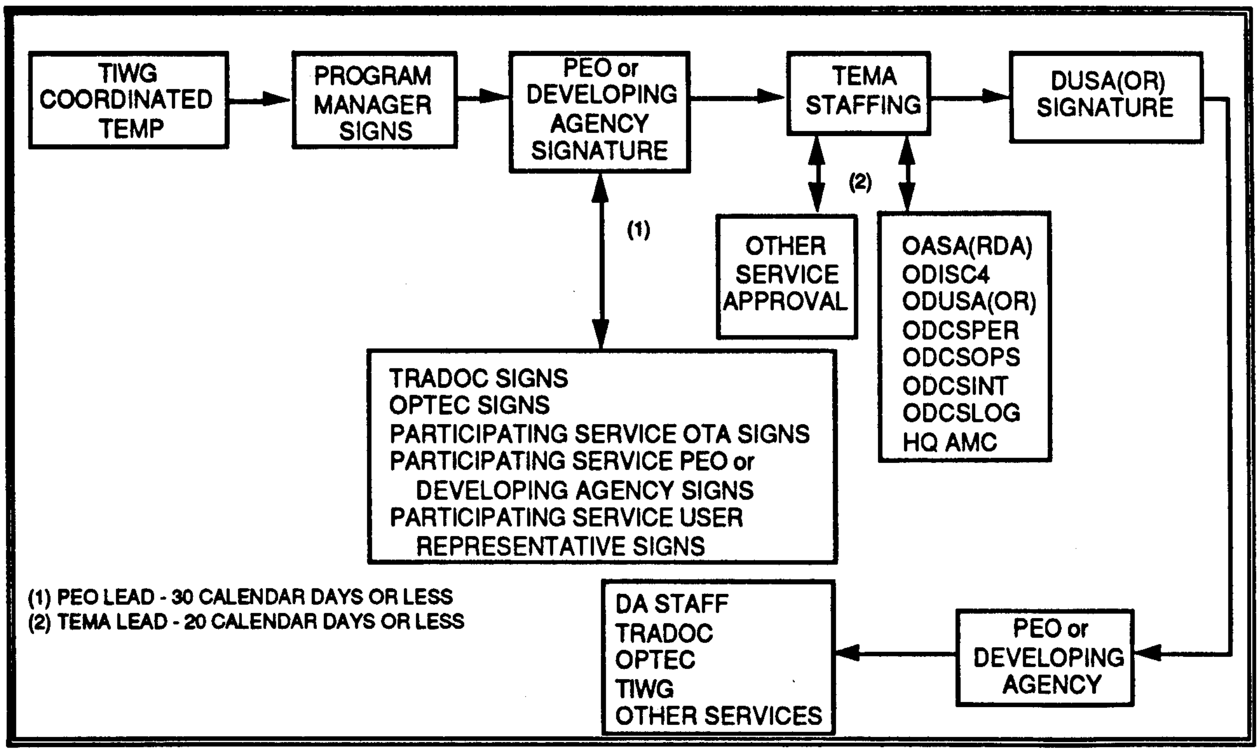

Figure 2-7. TEMP Staffing and Approval Process, Acquisition Category II Multiservice Materiel Programs, Army Lead

2-11. ACAT III and IV non-major Materiel Programs, not designated for OSD T&E Oversight and Class V Information Mission Area (IMA) Programs (to include Multiservice).

a. TIWG members should staff the TEMP within their organization to ensure complete review and concurrence during the initial 30 day TEMP review period. Substantive issues should be surfaced and resolved at the TIWG. TIWG member concurrence constitutes organization concurrence.

b. Approval is held in abeyance pending TIWG member senior management review. The review period for ACAT III and class V IMA is 20 working days and for ACAT IV, 10 working days after concurrence by an organization's TIWG member. On expiration of the review period, the TEMP approval authority signs the TEMP as approved and executable, provided no objections are received from TIWG organizations. The TEMP approval authority is the milestone decision authority.

c. TIWG member organization can reverse their concurrence within the designated review period by providing written notice of non-concurrence signed by senior management. The notice is to be sent to the program manager.

d. This process is reflected in figure 2-8.

e. The signature page format is shown in figure 3-5.

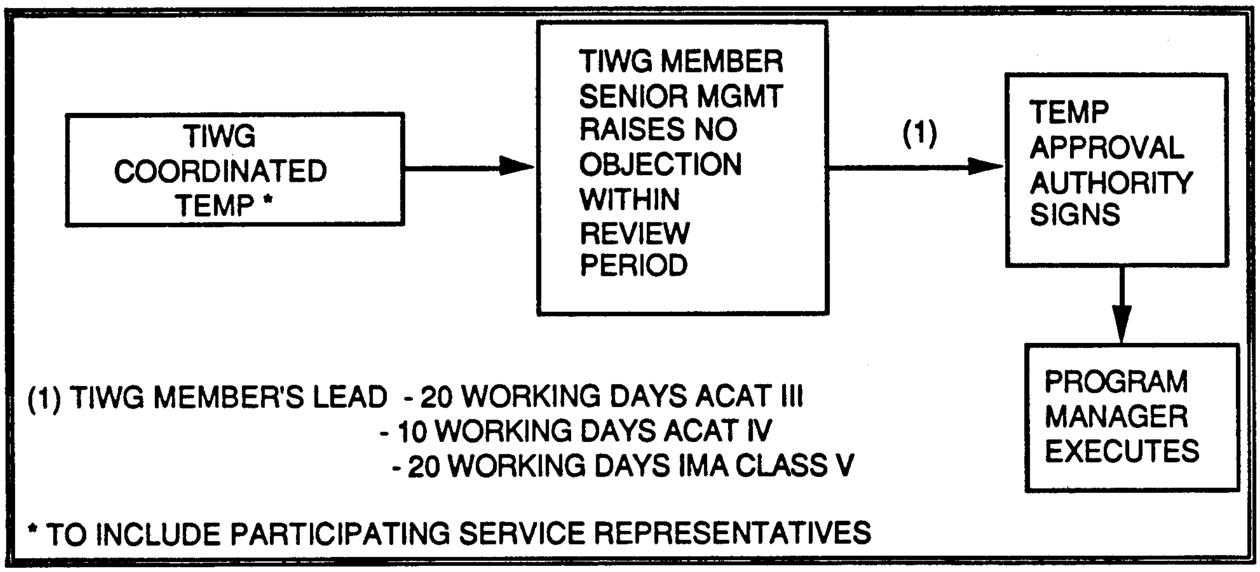

Figure 2-8. TEMP Staffing and Approval Process, Acquisition Category III & IV Materiel Programs, Not Designated for OSD Oversight and Class V Information Mission Area Programs (To Include Multiservice)

2-12. Major Automated Information System Review Council (MAISRC) programs.

a. The program manager signs in the "submitted by" signature block and forwards the TEMP to the PEO or developing agency, if not under PEO structure, for concurrence.

b. The PEO or developing agency forwards the TEMP to OPTEC and the Proponent/Functional Agency or HQ TRADOC for Theater/Tactical systems for concurrence. This coordination process should take no more than 30 calendar days.

c. The PEO or developing agency forwards the original and all necessary copies of the fully coordinated TEMP to TEMA for HQDA staffing and approval by the DUSA(OR). The number of copies required will be determined in coordination with TEMA.

d. If the system is an OSD MAISRC system the TEMP is forwarded by the DUSA(OR) to the D,T&E for review and OSD approval.

e. This process is reflected at figure 2-9 for Army MAISRC systems and at figure 2-10 for OSD MAISRC systems.

f. The signature page format for Army MAISRC is at figure 4-1; the signature page format for OSD MAISRC is at figure 4-2.

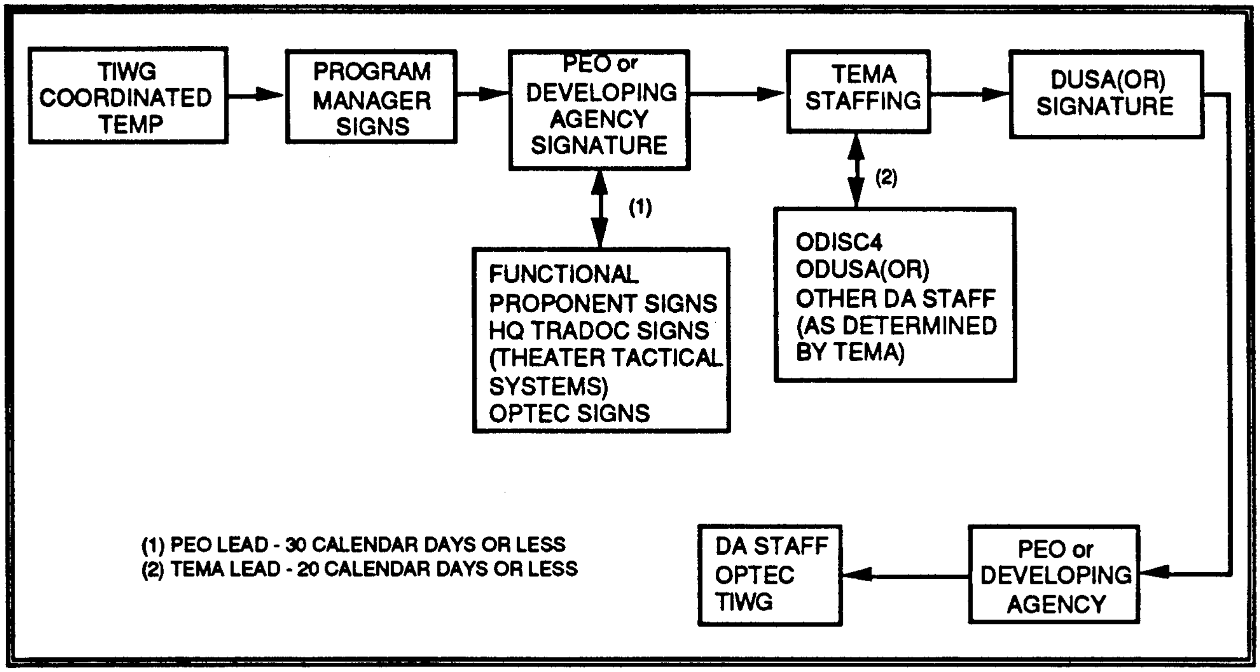

Figure 2-9. TEMP Staffing and Approval Process, Army MAISRC Programs

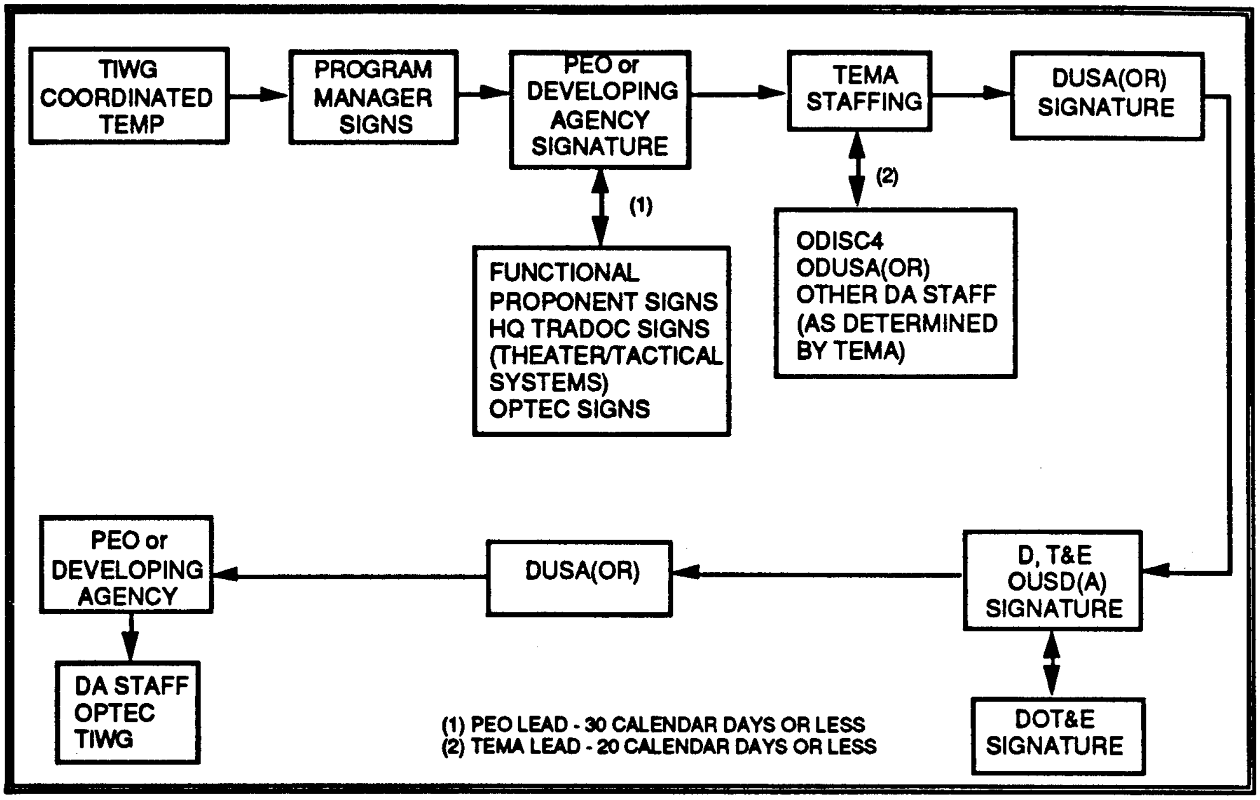

Figure 2-10. TEMP Staffing and Approval Process, OSD MAISRC Programs

Section III
TEMP update and revision.

2-13. Update.

A TEMP update is required to support milestone reviews, at program baseline breach, or on occasion when the program has changed significantly. The update can be in the form of a complete rewrite of the document, page changes or a memorandum indicating "no change". Page changes are the preferred approach when appropriate because they reduce the effort to review the TEMP, resulting in a speedier review and approval process. Page changes will be submitted as remove and replace changed pages so as not to affect the integrity of the basic document. Coordination and approval of the update is done according to the review and approval procedures appropriate for the acquisition category and TEMP approval authority of the program.

a. Coordination and approval is recorded by executing a TIWG Coordination Sheet and a TEMP Signature Page appropriate for the program. Signatures can be obtained via facsimile.

b. The initial submission date and the current update number and date will be shown on the TEMP cover, the TIWG Coordination Sheet and Signature Page.

c. Changes made to an approved TEMP will be annotated by change bars in the outside margin of changed pages. A synopsis of why specific changes were made will accompany the update. When page changes are used, each changed page will footnote the current date and change number.

d. A rewritten TEMP does not require changes to be noted by change bars, but should be accompanied by a synopsis of why changes were made.

e. The "no change" memorandum, when used for ACAT I and II and other ACATs designated for OSD T&E oversight as well as Army and OSD MAISRC programs, is prepared by the program manager, fully coordinated, and forwarded to TEMA for DUSA(OR) approval and forwarding to OSD, as appropriate. Both the TIWG Coordination Sheet and the TEMP Signature Page will be executed and forwarded as enclosures to the "no change" memorandum.

2-14. Revision.

A TEMP revision is required to address comments received during the review and approval process subsequent to TIWG concurrence. TEMPs for ACAT III and IV and IMA Class V programs are not subject to the procedures for revision unless they are on the OSD T&E Oversight list and/or when senior management's objections reverse the TIWG member concurrence. A revision is generally in the form of page changes although a complete rewrite of the document may be required if the changes are so substantial that page changes are not practical. Page changes will be submitted as remove and replace changed pages so as not to affect the integrity of the basic document. Coordination and approval of the revision is according to the approval procedures appropriate for the acquisition category and TEMP approval authority of the program.

a. For all revisions, TIWG members will be provided a copy of the changes for comment or concurrence to ensure changes are acceptable. Verbal concurrence will be provided by all principal TIWG members and recorded by the TIWG chairman. Verbal concurrence will be followed by a newly signed TIWG Coordination Sheet. The intent of the verbal concurrence is to expedite TIWG level TEMP concurrence. Signatures can be obtained via facsimile on separate pages for retention by the TIWG chairman.

b. A new TEMP Signature Page will be executed by the PM, PEO (or developing agency), HQ TRADOC or functional proponent for IMA systems and OPTEC for all revisions resulting from HQDA and OSD review.

c. The TEMP Signature Page will show the date of the basic document, the update number and date, if applicable, and the revision number and date as shown on the Signature Page format.

d. Changes made to the TEMP will be annotated by change bars in the outside margin of changed pages. A brief synopsis of how issues and comments were addressed and/or why specific changes were made will accompany the revision. Each changed page will footnote the revision number and current date.

e. A completely rewritten TEMP does not require changes to be noted by change bars but should be accompanied by a brief synopsis of how issues and comments were addressed and/or why specific changes were made to the TEMP.

f. The revision will be forwarded by memorandum to TEMA for HQDA review and DUSA(OR) approval and forwarding to OSD, as necessary. The memorandum will record that TIWG member concurrence was obtained and will enclose the properly executed TEMP Signature Page.

Section IV
Administration

2-15. Requesting delay in TEMP submittal.

The request for delay for ACAT I and II, MAISRC programs and all ACATs designated for OSD T&E oversight is prepared by the program manager and forwarded for approval to the TEMP approval authority. The reason for the delay must be clearly explained. Delays for administrative reasons are generally not accepted. The request for delay will be forwarded to TEMA for forwarding to OSD or DUSA(OR) approval, as necessary.

2-16. Publication considerations.

TEMPs, if bound, must allow for easy insertion of page changes; spiral binding, square or glue bindings are not acceptable. The program manager is responsible to provide the number of copies needed for HQDA and OSD staff review. Quantity needed is as previously identified in appropriate paragraphs in Section II. TEMPs submitted for HQDA and OSD approval must contain all classified data and appendices/annexes.

Chapter 3
Format and Contents for Materiel Programs

Section I
Introduction.

3-1. General.

a. The format for all Army developed Test and Evaluation Master Plans will be in accordance with Part 7, DoD 5000.2-M.

b. DoD 5000.2-M, Part 7, attachment 1, is replicated in whole in the following sections, except as noted below. Specific content guidance appropriate for Army TEMP preparation is noted in the boxed remarks following a given paragraph. Guidance for ACAT II, III, and IV programs is the same as for ACAT I, except as noted. Figures 3-8 and 3-9 are revised showing Army interpretation of the DoD guidance.

c. Signature Page formats and layout for programs by ACAT are provided at figures 3-1 to 3-5. Program element information can be obtained from the current year version of AR 37-100-XX.

d. An example of a TIWG Coordination Sheet is at figure 3-6. The TIWG Coordination Sheet should show the specific participants of a program, for example, the TIWG Chair should show the PM, program name, the specific school/center should be identified as the combat developer; AMSAA should be identified as the Developmental Evaluator or TECOM as the Developmental Assessor, etc.

e. A TEMP will include a Signature Page, a TIWG Coordination Sheet as shown in figure 3-6, and an Outline as shown in figure 3-7.

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

Program Manager	DATE

CONCURRENCE

Program Executive Officer (or Developing Agency, if no PEO)	DATE		
CDR, U.S. Army Operational Test & Evaluation Command (OPTEC)	DATE	DCS Combat, Doctrine & Development, USA TRADOC	DATE

COMPONENT APPROVAL

Deputy Under Secretary of the Army (Operations Research)	DATE

****

OSD APPROVAL

Director, Operational Test and Evaluation	DATE	Director, Test and Evaluation Under Secretary of Defense (Acquisition)	DATE

Figure 3-1. Signature Page format for ACAT I and other ACATs designated for OSD test and evaluation oversight.

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

Program Manager	DATE

CONCURRENCE

Program Executive Officer (or Developing Agency if no PEO)	DATE	Participating Service PEO or Developing Agency	DATE
CDR U.S. Army Operational Test & Evaluation Command (OPTEC)	DATE	Participating Service Operational Test Agency	DATE
DCS, Combat, Doctrine & Developments, USATRADOC	DATE	Participating Service User Representative	DATE

COMPONENT APPROVAL

Deputy Under Secretary of the Army (Operations Research)	DATE	Other Svc Acq Exec	DATE

****

OSD APPROVAL

Director, Operational Test and Evaluation	DATE	Director, Test and Evaluation Under Secretary of Defense (Acquisition)	DATE

Figure 3-2. Signature Page format for Multiservice ACAT I and other ACATs designated for OSD T&E oversight for which Army is the lead service.

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

____________________ ________
Program Manager DATE

CONCURRENCE

____________________ ________
Program Executive Officer DATE
(or Developing Agency if no PEO)

CDR, U.S. Army Operational Test & Evaluation Command (OPTEC)	DATE	DCS, Combat, Doctrine & Developments, USATRADOC	DATE

APPROVED BY

____________________ ________
Deputy Under Secretary of the Army (Operations Research) DATE

Figure 3-3. Signature Page format for ACAT II and Army Special Interest programs

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

Program Manager	DATE

CONCURRENCE

Program Executive Officer (or Developing Agency if no PEO)	DATE	Participating Service PEO or Developing Agency	DATE
CDR U.S. Army Operational Test & Evaluation Command (OPTEC)	DATE	Participating Service Operational Test Agency	DATE
DCS Combat, Doctrine & Development, USATRADOC	DATE	Participating Service User Representative	DATE

APPROVED BY

Deputy Under Secretary of the Army (Operations Research)	DATE	Other Svc Acq Exec	DATE

Figure 3-4. Signature Page format for Multiservice ACAT II programs for which Army is lead service.

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

SUBMITTED BY

________________________ __________
Program Manager DATE

APPROVED BY

________________________ __________
Milestone Decision Authority DATE

Figure 3-5. Signature Page format for Acquisition Category III & IV programs not subject to OSD T&E oversight and Class V Information Mission Area (IMA) programs (to include multiservice programs).

TIWG COORDINATION SHEET
TEMP FOR
PROGRAM TITLE
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

	Signature		Date
Program Manager (TIWG Chair)	________	CONCUR/NONCONCUR	________
Combat Developer/ (Proponent School/Center)	________	CONCUR/NONCONCUR	________
Developmental Tester (TECOM)	________	CONCUR/NONCONCUR	________
Develop Evaluator/Assessor (AMSAA/TECOM)	________	CONCUR/NONCONCUR	________
Operational Tester (TEXCOM)	________	CONCUR/NONCONCUR	________
Operational Evaluator (OEC)	________	CONCUR/NONCONCUR	________
Logistician (AMSAA)	________	CONCUR/NONCONCUR	________
Survivability/Lethality (SLAD)	________	CONCUR/NONCONCUR	________
Threat Integrator*	________	CONCUR/NONCONCUR	________
Other **	________	CONCUR/NONCONCUR	________

* If Applicable
**Include participating service representatives for multiservice programs.

Figure 3-6. Sample TEMP/TIWG Coordination Sheet.

TEST AND EVALUATION MASTER PLAN OUTLINE (FORMAT)

		Page Number
PART I	SYSTEM INTRODUCTION (2 pages suggested - refer to annexes)	
a.	Mission Description	xx
b.	System Threat Assessment	xx
c.	Minimum Acceptable Operational Performance Requirements	xx
d.	System Description	xx
e.	Critical Technical Parameters (See Figure 3-8)	xx
PART II	INTEGRATED TEST PROGRAM SUMMARY (2 pages suggested)	
a.	Integrated Test Program Schedule (See Figure 3-9)	xx
b.	Management	xx
PART III	DEVELOPMENTAL TEST AND EVALUATION OUTLINE (10 pages suggested)	
a.	Developmental Test and Evaluation Overview	xx
b.	Developmental Test and Evaluation to Date	xx
c.	Future Developmental Test and Evaluation	xx
d.	Live Fire Test and Evaluation	xx
PART IV	OPERATIONAL TEST AND EVALUATION OUTLINE (10 pages suggested)	
a.	Operational Test and Evaluation Overview	xx
b.	Critical Operational Issues	xx
c.	Operational Test and Evaluation to Date	xx
d.	Future Operational Test and Evaluation	xx
PART V	TEST AND EVALUATION RESOURCE SUMMARY (6 pages suggested)	
a.	Test Articles	xx
b.	Test Sites and Instrumentation	xx
c.	Test Support Equipment	xx
d.	Threat Systems/Simulators	xx
e.	Test Targets and Expendables	xx
f.	Operational Force Test Support	xx
g.	Simulations, Models and Testbeds	xx
h.	Special Requirements	xx
i.	T&E Funding Requirements	xx
j.	Manpower/Personnel Training	xx
APPENDIX A	Bibliography	A-1
APPENDIX B	Acronyms	B-1
APPENDIX C	Points of Contact	C-1
ANNEXES/ATTACHMENTS (if appropriate)		

Figure 3-7. Test and Evaluation Master Plan Outline.

Section II
TEMP Format and Content for Materiel Systems

3-2. TEST AND EVALUATION MASTER PLAN CONTENT (FORMAT)

PART I -- SYSTEM INTRODUCTION

a. Mission Description. Reference the Mission Need Statement and briefly summarize the mission need described therein.

> Define the need in terms of mission, objectives and general capabilities.
>
> Summarize from Paragraph 2, Mission Need Statement (MNS).
>
> Describe the natural environment in two aspects; logistically and operationally. Summarize from paragraph 4, MNS.

b. System Threat Assessment. Reference the system threat assessment and briefly summarize the threat environment described herein.

> Summarize the operational threat environment from paragraph 4c, System Threat Assessment Report (STAR) and the system specific threat from paragraph 4e, STAR. Include the threat at IOC, follow-on - at IOC plus 10 and the reactive threat from paragraph 4e and 4f (if applicable).
>
> For ACAT III and IV programs, summarize the above information from the System Threat Assessment (STA).

c. Minimum Acceptable Operational Performance Requirements.

Reference the Operational Requirements Document and summarize the critical operational effectiveness and suitability parameters and constraints (manpower, personnel, training, software, computer resources, transportation (lift), etc.) described therein.

> Summarize from the Operational Requirements Document (ORD) Paragraphs 4, 5, and 6.
>
> Discuss the relationship between the critical operational effectiveness and suitability parameters and the Measures of Effectiveness (MOE) in the COEA.
>
> Operational requirements are specified in the Software Requirements Specification.
>
> For ACAT III and IV programs, not designated for OSD T&E oversight, it is sufficient to reference the ORD.

d. System Description. Briefly describe the system design. Include the following items:

(1) Key features and subsystems, both hardware and software (such as architecture, interfaces, security levels, reserves, etc.), allowing the system to perform its required operational mission.

(2) Interfaces with existing or planned systems that are required for mission accomplishment. Address relative maturity and integration and modification requirements for nondevelopment items. Include interoperability with existing and/or planned systems of other DoD Components or allies.

(3) Critical system characteristics (see Section 4-C of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures,") or unique support concepts resulting in special test and analysis requirements (e.g., post deployment software support, hardness against nuclear effects; resistance to countermeasures; development of new threat simulation, simulators, or targets.)

> For MS I summarize from ORD or from development specification if available.
>
> For MS II and beyond summarize from development specification.
>
> Include line drawing of system if available.
>
> For software, describe the overall system with emphasis on where Mission Critical Computer Resources (MCCR) are used.
>
> Include a single paragraph synopsis of any unique training concepts, logistical support concepts, e.g., life cycle contractor support and maintenance concepts to include planned levels for maintenance support.

Include a description of what constitutes the Initial Operational Capability (IOC) and the Full Operational Capability (FOC) for the system.

e. Critical Technical Parameters.

(1) List in a matrix format (see Figure 3-8) the critical technical parameters of the system (including software maturity and performance measures) that have been evaluated or will be evaluated during the remaining phases of developmental testing. Critical technical parameters are derived from the Operational Requirements Document, critical system characteristics (see Part 4 of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures") and technical performance measures (see Section 6-A of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures") and should include the parameters in the acquisition program baseline (see Part 14, DoD 5000.2-M). Discuss the relationship between the critical technical parameters and the minimum acceptable operational performance requirements in the Operational Requirements Document.

(2) Next to each technical parameter, list the accompanying objectives and thresholds as illustrated by Figure 3-8.

Critical Technical Parameters	Total events	Technical objective for each test event	Location	Schedule	Decision supported	Demonstrated Value
Measureable Parameter with reference	Single event or test phase	Measureable Technical value	Test facility	Test period	Milestone in-process review or major event	(Include the Actual Value)
Detection range 10.0 Km (reference)	EDT PPT PPQT	7.0 Km 9.0 KM 10.0 Km	ABCRange DEF Range DEF Range	1Q FY-XX 2Q FY-XX 3Q FY-XX	M/S II M/S III M/S III	X Y Z

Figure 3-8. Sample Critical Technical Parameters Matrix (This matrix depicts the evaluation criteria to assess developmental progress)

Critical Technical Parameters - obtained from the ORD and related documents and discussed in the Acquisition Program Baseline (APB).

Reference - the source from which the parameter and value is derived.

Total events - the developmental tests conducted wherein the parameters are tested. Tests should be outlined in Part III.

Technical objective for each event - the value expected to be attained at that stage of development.

Location - the place where the test will be performed. Normally a TECOM test facility.

Schedule - the fiscal quarter when the test will be initiated.

Decision Supported - the program milestone or review that will consider the results of this test.

Demonstrated Value - state the actual value obtained from testing.

A MS I (preliminary) TEMP is not expected to contain detailed requirements. The TEMP update to support Milestone II (subsequent to ORD approval) should include detailed values.

(3) Highlight critical technical parameters that must be demonstrated before entering the next acquisition or operational test phase and ensure that the actual values which have been demonstrated to date are included in the last column.

Critical technical parameters are defined as those measurable critical system characteristics including software, that when achieved, allow the attainment of the minimum acceptable operational performance requirements.

Software critical technical parameters may include language, architecture, interfaces, supportability, security levels, time, memory, and input/output reserves. For systems conforming to DoD STD 2167A, a matrix relating to the critical technical parameters may be found in the Software Specification

Discuss the relationships between the critical technical parameters for test, the Measures of Performance (MOP) in the COEA, and the critical system characteristics, objectives and thresholds in the ORD.

PART II -- INTEGRATED TEST PROGRAM SUMMARY

a. Integrated Test Program Schedule

(1) As illustrated in Figure 3-9, display on a chart the integrated time sequencing of the critical test and evaluation phases and events, related activities, and planned cumulative funding expenditures by appropriation.

(2) Include event dates such as milestone decision points; operational assessments, test article availability; software version releases; appropriate live fire test and evaluation, and operational test and evaluation; low rate initial production deliveries; Full Rate Production deliveries; Initial Operational Capability; Full Operational Capability; and statutorily required reports.

(3) A single schedule should be provided for multi-Service or Joint and Capstone Test and Evaluation Master Plans showing all DoD Component system event dates.

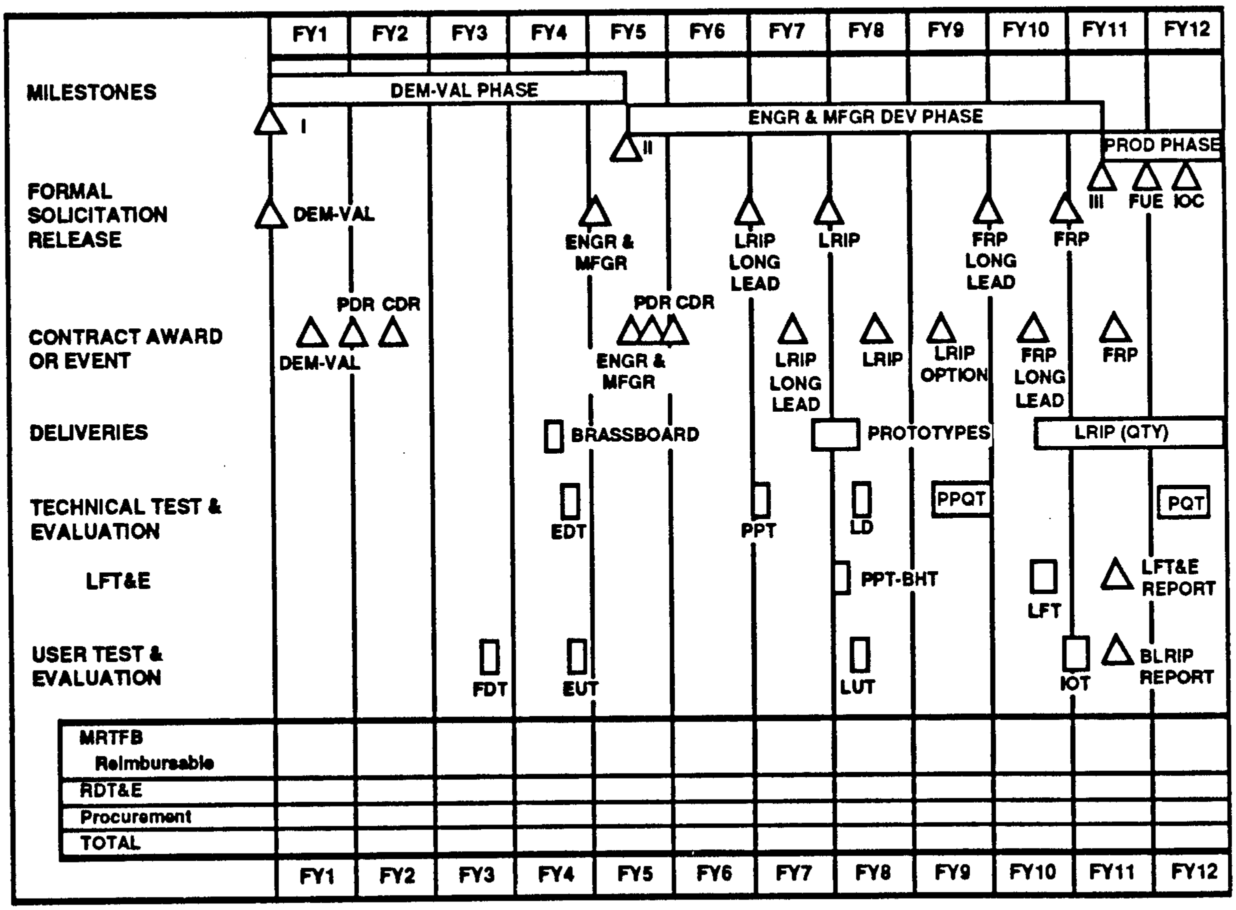

Figure 3-9. Integrated Test Program Schedule (Illustrative Example)

The integrated test program schedule will be divided into seven major areas: Program Milestones; Program Acquisition Events; Contract Release and Awards; Program Deliverables; Developmental Test and Evaluation; Operational Test and Evaluation and Program Funding. Figure 3-9 provides an illustrated example of an integrated test program schedule.

For ACAT III and IV programs not on the OSD T&E Oversight list it is not critical to adhere to the exact format of figure 3-9. A chart showing the program milestones and the planned tests is adequate.

Can be a fold-out

Must cover the acquisition and test & evaluation program through full operational capability

The integrated time sequencing of critical events will be reflected as appropriate (for example):

MILESTONES: I, II, III, First Unit Equiped (FUE), Initial Operational Capability (IOC).

FORMAL SOLICITATION RELEASE:

Demonstration Validation (Dem-Val) RFP Release
Low Rate Initial Production (LRIP) RFP Release
Engineering & Manufacturing Development RFP Release
Full Rate Production (FRP) Long Lead RFP Release

CONTRACT AWARD OR EVENT:

Demonstration Validation Award
Engineering & Manufacturing Development Award
LRIP Long Lead Item Award
LRIP Options
FRP Long Lead Award
Preliminary Design Review (PDR)
Critical Design Review (CDR)

DELIVERIES:

Brassboard
Prototype (Designate Quantity)
LRIP (Designate Quantity)
Production (Designate Quantity)

TECHNICAL TEST & EVALUATION (DT&E):

Developmental Tests

Pre-Milestone II
- Technical Feasibility Test (TFT)
- Engineering Development Test (EDT)

Pre-Milestone III
- Pre-production Qualification Test (PPQT)
- Production Prove-Out Test (PPT)
- Live Fire Test (LFT)
- Logistic Demonstration (LD)

Production and Deployment Phase
- Production Qualification Test (PQT)
- First Article Test (FAT)

USER TEST & EVALUATION (OT&E):

Early Operational Assessment
Operational Assessment

Operational Tests

Pre-MS II
- Early User Test (EUT)
- Early User Experiment (EUE)

Pre-MS III
- Limited User Test (LUT)
- Initial Operational Test (IOT)

Production and Deployment Phase
- Follow-on Operational Test (FOT)

As Required
- Force Development Test (FDT)
- Force Development Experiment (FDE)
- Concept Evaluation Program Test (CEP)

FUNDING - cumulative by fiscal year
- include all funds expended by the PM, support agencies and the test agencies.

MRTFB Reimbursable - obtain data from the program planning forecast document that addresses developmental test at US Army Test and Evaluation Command (TECOM) test facilities and other DoD managed facilities. See Chapter 8, AR 73-1 and Part Four.

RDT&E
- include all RDT&E expenditures, not just T&E related
- include DT&E and OT&E costs
- include LRIP and Test Articles for DT&E and IOT&E
- as described in Chapter 8, AR 73-1

> PROCUREMENT - as described in program baseline
>
> For ACAT III and IV programs, not designated for OSD T&E oversight, funding information on the Integrated Program Schedule is optional.

b. Management

(1) Discuss the test and evaluation responsibility of all participating organizations (developers, testers, evaluators, users).

> Identify TIWG members and their role. Reference the TIWG charter for specific responsibilities. (See AR 73-1 and Part One, Chapter 8.) The TIWG charter must be included as a reference in Appendix A, Bibliography. For example:
>
> | | |
> |---|---|
> | Program Manager/TIWG Chair | PM (System) |
> | Combat Developer | TRADOC proponent school |
> | Operational Evaluator | OEC |
> | Operational Tester | TEXCOM |
> | Developmental Evaluator/Assessor | AMSAA/TECOM |
> | Developmental Tester | TECOM |
> | Logistician | AMSAA |
> | Survivability/Lethality | SLAD, Army Research Lab |
> | Threat Integrator | DCSINT |
> | Participating Service OTA | AFOTEC, MCOTEA, COMOPTEVFOR |
> | Participating Service User Representative (if multi-service) | |
> | IV&V Agency | ARDEC |
>
> For ACAT III and IV programs, not designated for OSD T&E oversight, it is sufficient to reference the TIWG charter.
>
> If the Human Use Committee (HUC) makes a recommendation that there is no further test plan review required and that recommendation is approved by the test plan approval authority, the recommendation is to be noted in this paragraph and reference made to the decision document in Appendix A, Bibliography. (See AR 70-25)

(2) Provide the date (fiscal quarter) when the decision to proceed beyond low-rate initial production is planned. (Low-rate initial production quantities required for operational test must be identified for the Director of Operational Test and Evaluation approval prior to Milestone II for acquisition category I programs and other acquisition category programs designated for Office of the Secretary of Defense test and evaluation oversight).

The date for the Beyond Low Rate Initial Production (BLRIP) decision is found in the Integrated Program Summary (IPS), Acquisition Strategy Report.

The quantity of LRIP items needed for IOT is recommended by OPTEC in coordination with the program manager and included for approval by DOT&E for ACAT I and other ACAT programs having OSD test and evaluation oversight.

The quantity of items needed for IOT for all other ACAT programs are included as recommended by OPTEC.

(3) Identify and discuss any operational issues and vulnerability and lethality Live Fire Test requirements that will not be addressed before proceeding beyond low-rate initial production.

PART III -- DEVELOPMENTAL TEST AND EVALUATION OUTLINE

a. Developmental Test and Evaluation Overview. Explain how developmental test and evaluation will: verify the status of engineering and manufacturing development progress; verify that design risks have been minimized; and substantiate achievement of contract technical performance requirements; and be used to certify readiness for dedicated operational test. Specifically, identify:

(1) Any technology/subsystem that has not demonstrated its ability to contribute to system performance and ultimately fulfill mission requirements.

(2) The degree to which system hardware and software design has stabilized so as to reduce manufacturing and production decision uncertainties.

Summarize the entire developmental test and evaluation program.

Present a narrative walk-through of the integrated schedule, discussing the interrelationships between tests, developmental and operational, and between tests and milestones. Do not duplicate details that will be found in para 3c, Future Developmental Test and Evaluation. The purpose of the Overview is to identify how the individual tests fit within the framework of the overall program and the continuous evaluation process. Some of the topics that need to be addressed in this paragraph include:

(1) Early developmental tests that will be performed to mitigate technical risks in the program that are defined in the Risk Assessment, Annex D, Integrated Program Summary (Reference DoD 5000.2-M, Part 4, Annex E.).

(2) Identification of developmental tests that will be used to demonstrate that the test item is safe, that the technical manuals are verified and validated and ready for usage in a following or concurrent Operational Test.

(3) Identification of the test, usually Pre-production Qualification Test (PPQT), that will be performed to validate that the system meets the program's technical performance requirements that are usually contractually mandated in a specification.

(4) The developmental test(s) that will be used to certify the system is ready for Initial Operational Test (IOT) and who has responsibility for execution.

(5) If applicable, testing to address conventional weapon effects, Electromagnetic and Environmental Effect (E^3), ECM/ECCM, initial nuclear weapons effects, advanced technology survivability and NBC contamination survivability (Reference DoDI 5000.2, Part 6, Section F.)

(6) Identification of the test plans and strategy to prove or validate the manufacturing process (Reference DoDI 5000.2, Part 6, Section O).

The following areas need to be addressed throughout Developmental Test and Evaluation (They are addressed in general in the DT&E Overview and specifically in the description, objective, etc, of each of the developmental tests addressed in Future DT&E.):

Reliability, Availability, and Maintainability (Reference DoDI 5000.2, Part 6, Section C.)

Electromagnetic Compatibility and Radio Frequency Management (Reference DoDI 5000.2, Part 6, Section G)

Human Factors (Reference DoDI 5000.2, Part 6, Section H)

System Safety, Health Hazards and Environment (Reference DoDI 5000.2, Part 6, Section I)

Integrated Logistical Support (Reference DoDI 5000.2, Part 7, Section A). A Logistics Demonstration (LD) is required for all acquisition programs unless waived. (See AR 700-127) The waiver if approved will be documented in Part II, paragraph 2 with the approval document referenced in the Bibliography, Appendix A.

Discuss the indicators that will be used to determine software status and evaluate progress toward software maturity in support of key decision points, particularly for software intensive systems. Show how the indicators in each phase relate to those in previous and subsequent phases.

b. Developmental Test and Evaluation to Date. Identify completed developmental test and evaluation by noting on the matrix of critical technical parameters those parameters that have been demonstrated.

Update the Critical Technical Parameters matrix in Part I. Note the actual values that have been demonstrated.

For parameters not met, provide a brief explanation as to why and performance impact. Identify future test that will re-address parameters.

A detailed discussion of the results of testing is not required.

Test and evaluation reports prepared to date must be included as references in Appendix A. Bibliography.

c. Future Developmental Test and Evaluation. Discuss all remaining developmental test and evaluation that is planned, beginning with the date of the current Test and Evaluation Master Plan revision and extending through completion of production. Place emphasis on the next phase of testing. For each phase, include:

For each test within each remaining acquisition phase address the following items: configuration description, DT&E objectives, DT&E events, scope, basic scenarios and limitations e.g., (1) Demonstration Validation

(a) Chassis Design Test

(1) Configuration description (of test item)
(2) Test and Evaluation Objectives
(3) Events, Scope of Testing, and Basic Scenarios
(4) Limitations

> (2) Engineering and Manufacturing Development
> (a) Pre-Production Qualification Test
> (1) Configuration description (of test item)
> (2) Test and Evaluation Objectives
> (3) Events, Scope of Testings and Basic Scenarios
> (4) Limitations
>
> For those critical technical parameters where demonstrated value did not meet the threshold or objective, planned testing must insure that these parameters will be re-addressed.

(1) Configuration Description. Summarize the functional capabilities of the system's developmental configuration and how they differ from the production model.

> List the difference between the system to be tested and the objective system, to include software.

(2) Developmental Test and Evaluation Objectives. State the test objectives for this phase in terms of the critical technical parameters to be confirmed. Identify any specific technical parameters which the milestone decision authority has designated as exit criteria and/or directed to be demonstrated in a given phase of testing.

> Exit criteria are generally found in the Acquisition Decision Memorandum (ADM) for ACAT I & II programs.
>
> For ACAT III & IV, exit criteria can be found in the IPR decision documentation.

(3) Developmental Test and Evaluation Events, Scope of Testing, and Basic Scenarios. Summarize the test events, test scenarios and the test design concept Quantify the testing (i.e., number of test hours, test events, test firings). List the specific threat systems, surrogates, countermeasures, component or subsystem testing, and testbeds the use of which are critical to determine whether developmental test objectives are achieved. As appropriate, particularly if an agency separate from the test agency will be doing a significant part of the evaluation, described the methods of evaluation. List all models and simulations to be used and explain the rationale for their credible use. Describe how performance in natural environmental conditions representative of the intended area of operations (e.g., temperature, pressure, humidity, fog, precipitation, clouds, blowing dust and sand, icing, wind conditions, steep terrain, wet soil conditions, high sea state, storm surge and

tides, etc.) and interoperability and compatibility with other weapon and support systems as applicable will be tested.

> The resources identified must correspond to those listed in Part V.
>
> Include discussion of any test databases and/or remote terminal emulators to be used and their relationship to the objective system environment.

(4) Limitations. Discuss the test limitations that may significantly affect the evaluator's ability to draw conclusions, the impact of these limitations, and resolution approaches.

> Identify the differences between the COEA environment and the test environment that would affect the ability to use test data in validating the COEA database used for predicting operational effectiveness.

d. Live Fire Test and Evaluation. Include a description of the overall live fire test and evaluation strategy for the item; critical live fire test and evaluation issues; required levels of system vulnerability/lethality; the management of the live fire test and evaluation program live fire test and evaluation schedule, funding plans and requirements; related prior and future live fire test and evaluation efforts; the evaluation plan and shot selection process; and major test limitations for the conduct of live fire test and evaluation. Live fire test and evaluation resource requirements (including test articles and instrumentation) will be appropriately identified in the Test and Evaluation Resource Summary.

> This paragraph applies to those systems that are identified as a covered system or major munition program as defined in Title 10, United States Code, Section 2366.
>
> Do not address LFT&E in a separate annex.
>
> See Part Five for details on LFT&E.
>
> Group all vulnerability/lethality testing (when applicable) under one paragraph to show how the vulnerability/lethality issue is being assessed through various tests and subtests. Such testing can include dedicated tests such as Ballistic Hull and Turret testing and Live Fire Test. Subtests can include armor plate tests, penetration tests, as well as other tests that validate the vulnerability/lethality requirements of a program.

> Provide an executive level summary discussion.
>
> Summarize LFT details as appropriate throughout the TEMP.
>
> Leave detailed discussion to the test plans.

Part IV -- OPERATIONAL TEST AND EVALUATION OUTLINE

a. Operational Test and Evaluation Overview

(1) The primary purpose of operational testing and evaluation is to verify that operationally effective and operationally suitable systems are approved for production that meet the mission needs and minimum operational performance requirements of the operating forces.

(2) The Test and Evaluation Master Plan will show how program schedule, test management structure, and required resources are related to operational requirements, critical operational issues, test objectives, and milestone decision points. Testing will evaluate the system (operated by typical users) in an environment as operationally realistic as possible, including threat representative hostile forces and the expected range of natural environmental conditions.

> Summarize the entire operational test and evaluation program and the evaluation strategy. Present a narrative walk-through of the integrated schedule discussing the interrelationships between contractor, government, developmental and operational tests, models and simulations and the milestones they support. Do not duplicate the details that are provided in paragraph 4.d, Future Operational Test and Evaluation. The purpose of the overview is to give a quick, concise look at the overall test program, explaining the many interrelationships and opportunities to conduct continuous evaluation (CE). Some of the topics that need to be addressed include:
>
> (1) Identification of contractor and developmental tests that will be used as part of an operational evaluation or assessment.
>
> (2) Identification of simulations that will be used to augment and extend operational testing as part of an operational evaluation or assessment.
>
> (3) Key characteristics of the system that will be the focus of the evaluation.
>
> (4) Sources of data, baseline comparisons, general analysis scheme and test data/COEA linkage.

> The following areas need to be addressed throughout Operational Test and Evaluation (They are addressed in general in the OT&E Overview and specifically in the description, objective, etc, of each of the operational tests addressed in Future OT&E.):
>
> Human performance issues must be addressed (Reference DoDI 5000.2, part 7, Section B).
>
> Logistics support issues (readiness, reliability, availability and maintainability) to include Test, Measurement and Diagnostic Equipment (TMDE) and integrated diagnostics must be addressed (Reference DoDI 5000.2, part 7, Section A).

b. Critical Operational Issues

(1) List in this section the critical operational issues. Critical operational issues are the operational effectiveness and operational suitability issues (not parameters, objectives or thresholds) that must be examined in operational test and evaluation to evaluate/assess the system's capability to perform its mission.

(2) A critical operational issue is typically phrased as a question that must be answered in order to properly evaluate operational effectiveness (e.g.,"Will the system detect the threat in a combat environment at adequate range to allow successful engagement?") and operational suitability (e.g., "Will the system be safe to operate in a combat environment?").

(3) Some critical operational issues will have critical technical parameters and minimum acceptable operational performance requirements or thresholds. Individual attainment of these attributes does not guarantee that the critical operational issue will be favorably resolved. The judgment of the operational test agency is used by the DoD Component to determine if the critical operational issue is favorably resolved.

(4) If every critical operational issue is resolved favorably, the system should be operationally effective and operationally suitable when employed in its intended environment by typical users.

> TRADOC approved Critical Operational Issues and Criteria (COIC) are required for all programs at MS I and for ACAT III & IV programs at all milestones.
>
> DCSOPS approved COIC are required for ACAT I, II and OSD T&E oversight systems at MS II and beyond.

> Army policy (AR 73-1, para 5-8) requires approved COIC be included in the TEMP.
>
> Include the approved COICs in their entirety in the TEMP; this includes Issue, Scope, Criteria and Rationale.
>
> Discuss the relationships between the criteria in the COIC, the minimum acceptable operational performance requirements in the ORD and the MOEs with supporting MOPs in the COEA. Should be part of the COIC rationale statement.
>
> Reference the COIC approval document in Appendix A, Bibliography.

c. Operational Test and Evaluation to Date. Identify and date test reports that detail the results of testing and operational assessments to date. Indicate critical operational issues that were resolved (satisfactory, unsatisfactory, yes, no etc.), partially resolved, or unresolved at the completion of each phase of testing.

> The results related to the resolution of the criteria in addition to the overall issue should be discussed.
>
> Ensure that all test reports referenced are listed in Appendix A, Bibliography. Reports must be available if requested.
>
> For software, within the context of previously identified operational issues, summarize what has been learned from the operational test accomplished to date about the maturity of the software. Show how operational test results from interim hardware and software configurations apply to configurations intended for deployment. Identify differences between tested software, software planned for the current phase, and software to be deployed. Discuss the importance of these differences.

d. Future Operational Test and Evaluation. For each remaining phase of operational test and evaluation, separately address the following:

> Identify operational tests that will be conducted and the developmental tests that will be used as data for operational evaluation or assessment. When developmental tests are identified, subparagraph (3) Events, Scope of Testing and Scenarios should define the data in general terms that will be taken from the developmental test for the evaluation or assessment. This will ensure that the developmental testers and evaluators, by their signature on the TEMP, have agreed to collect and provide that data to the operational evaluator.

Describe how models will be accredited for use in this specific application. The approval vehicle for accreditation is an Accreditation Plan as outlined in DUSA(OR) memo dated 30 Oct 89, subject: Verification, Validation, and Accreditation of Models. Reference the Accreditation Plan in Appendix A, Bibliography.

Part V, Resource Summary will identify the resources necessary to perform the validation and/or accreditation.

If more than one test is in a phase, the following layout should be included for each test. For example:

(1) Demonstration/Validation
(a) Early User Test (EUT)
 (1) Configuration description (of test item)
 (2) Test and Evaluation Objectives
 (3) Events, Scope of Testing and Scenarios
 (4) Limitations
(b) (Next test within Dem/Val phase)

(Note: Either list each sub-element for the developmental test to be used for data or refer to the applicable paragraph in Part III that contains the information.)

(2) Engineering and Manufacturing Development
(a) Initial Operational Test and Evaluation
 (1) Configuration description (of test item)
 (2) Test and Evaluation Objectives
 (3) Events, Scope of Testing and Scenarios
 (4) Limitations.
(b) (Next test within EMD phase.)

(1) Configuration Description. Identify the system to be tested during each phase, and describe any differences between the tested system and the system that will be fielded including, where applicable, software maturity performance and criticality to mission performance, and the extent of integration with other systems with which it must be interoperable or compatible. Characterize the system (e.g., prototype, engineering development model, production representative or production configuration)

(2) Operational Test and Evaluation Objectives. State the test objectives including the minimum acceptable operational performance requirements and critical operational issues to be addressed by each phase of operational test and evaluation and the milestone decision review(s) supported. Operational test and evaluation that supports the beyond low rate initial production decision should have test objectives that examine all areas of operational effectiveness and suitability.

> Discuss the relationship between OT&E objectives and the software characteristics which affect critical operational issues.
>
> For FOT&E, identify major deficiency corrections to be verified. OTs should be designed to assure that software is fault tolerant and supportable.

(3) Operational Test and Evaluation Events, Scope of Testing, and Scenarios. Summarize the scenarios and identify the events to be conducted, type of resources to be used, the threat simulators and the simulation(s) to be employed, the type of representative personnel who will operate and maintain the system, the status of the logistic support, the operational and maintenance documentation that will be used, the environment under which the system is to be employed and supported during testing, the plans for interoperability and compatibility testing with other United States/Allied weapon and support systems as applicable, etc. Identify planned sources of information (e.g., developmental testing, testing of) related systems, modeling, simulation, etc.) that may be used by the operational test agency to supplement this phase of operational test and evaluation. Whenever models and simulations are to be used, explain the rationale for their credible use. If operational test and evaluation cannot be conducted or completed in this phase of testing and the outcome will be an operational assessment instead of an evaluation, this should clearly be stated and the reason(s) explained.

> Include a description of the relationship between software functions being tested and test scenario events that will cause that function to be exercised. Identify load levels to be used and their relationship to the required operational environment.

(4) Limitations. Discuss the test limitations including threat realism, resource availability, limited operational (military, climatic, nuclear, etc.) environments, limited support environment, maturity of tested system, safety, etc., that may impact the resolution of affected critical operational issues. Indicate the impact of the test limitations on the ability to resolve critical operational issues and the ability to formulate conclusions regarding operational effectiveness and operational suitability. Indicate the critical operational issues affected in parenthesis after each limitation.

Identify any factors which may inhibit realistic OT of the software. Constraints imposed by software maturity or availability of resources and simulators should be given along with their impact on critical operational issues.

Identify differences between the COEA environment and the test environment that would affect the ability to use test data in validating the COEA database used for predicting operational effectiveness.

PART V -- TEST AND EVALUATION RESOURCE SUMMARY

Provide a summary (preferably in a table or matrix format) of all key test and evaluation resources, both government and contractor, which will be used during the course of the acquisition program. Specifically, identify the following test resources:

A matrix or table is preferred to identify planned use of available key assets and requirements for a new or unique capability or item that needs to be acquired or developed to support the test program. The following should be addressed:

test articles
test sites and instrumentation
test support equipment
threat systems/simulators
test targets and expendables
simulations, models and testbeds

Developmental tester and operational tester should provide input specific to their requirements. Indicate which requirements were identified by each tester

Existing capabilities that are key to accomplishing the test program need be included and specifically all those where use is known to be restricted or significant upgrade or improvement is needed.

The matrix should, at a minimum, identify the item, the quantity or number required, the location, the test event or time frame when needed, the resources required to be obtained and the organization/activity responsible for acquisition or development.

Software resource requirements are found in the Computer Resources Life Cycle Management Plan (CRLCMP).

a. Test Articles. Identify the actual number of and timing requirements for all test articles, including key support equipment and technical information required for testing in each phase by major type of developmental test and evaluation and operational test and evaluation. If key subsystems (components, assemblies, subassemblies or software modules) are to be tested individually, before being tested in the final system configuration, identify each subsystem in the Test and Evaluation Master Plan and the quantity required. Specifically identify when prototype, engineering development, pre-production, or production models will be used.

b. Test Sites and Instrumentation. Identify the specific test ranges/facilities to be used for each type of testing. Compare the requirements for test ranges/facilities dictated by the scope and content of planned testing with existing and programmed test range/facility capability, and highlight any major shortfalls, such as inability to test under representative natural environmental conditions.

Identify instrumentation that must be acquired specifically to conduct the planned test program.

> This includes software facilities and tools to support testing identified in Parts III and IV.
>
> Address shortfalls and impact under Limitations in Part III and/or Part IV as applicable.
>
> Testing shall be planned and conducted to take full advantage of existing investment in DOD ranges, facilities and other resources, wherever practical (Reference DoDI 5000.2, Part 8, paragraph 2.d.(4)).
>
> In order for the Army to realize maximum value of its capital investment in test facilities, it is necessary that PEO/PMs coordinate developmental test and evaluation requirements with TECOM. This should be accomplished early in the acquisition cycle, preferably prior to MS I. This coordination should facilitate the development of developmental testing requirements and determine the extent and nature of contractor services, if required. If TECOM cannot conduct the developmental test (e.g., scheduling does not permit), the PEO/PM has the authority to use contractor support. This decision and rationale will be documented in this paragraph of the TEMP.
>
> Address instrumentation that must be developed and/or procured. Clearly identify the test investment requirement to ensure test site instrumentation availability and capability.

c. Test Support Equipment. Identify test support equipment that must be acquired specifically to conduct the test program.

> Only address new test support equipment. This includes software test drivers, emulators or diagnostics, if applicable, to support identified testing. Identify unique or special calibration requirements associated with this test support equipment.

d. Threat Systems/Simulators. Identify the type, number, availability, and fidelity requirements for all threat systems/simulators. Compare the requirements for threat systems/simulators with available and projected assets and their capabilities. Highlight any major shortfalls. Each threat simulator shall be subjected to validation procedures to establish and document a baseline comparison with its associated threat and to ascertain the extent of the operational and technical performance differences between the two throughout the simulator's life-cycle.

> Threat systems/simulators to be used in activities supporting milestone decisions must be validated and accredited for the specific application. Validation and accreditation procedures are to be documented in accordance with the Army Validation and Accreditation Plan as described in Part Nine. The resulting report should be cited in Appendix A, Bibliography.

e. Test Targets and Expendables. Identify the type, number, and availability requirements for all targets, flares, chaff, sonobuoys, smoke generators, acoustic countermeasures, etc., that will be required for each phase of testing. Identify any major shortfalls.

> Include threat targets for LFT lethality testing and threat munitions for vulnerability testing. High fidelity targets require the same validation and accreditation process as for threat systems and simulators. Procedures described in Part Nine also apply. Results of this effort should be cited in Appendix A, Bibliography.

f. Operational Force Test Support. For each test and evaluation phase, identify the type and timing of aircraft flying hours, ship steaming days, and on-orbit satellite contacts/coverage, and other critical operating force support required.

> Include size, location and type unit of unit required.

g. Simulation, Models, and Testbeds. For each test and evaluation phase, identify the system simulations required, including computer-driven simulation models and hardware/software-in-the-loop testbeds. Identify the resources required to validate and certify their credible usage or application before their use.

> Include only those simulations, models and testbeds that will be used to extend testing and/or used in evaluation. This includes feeder models.
>
> Simulations, models and test beds used solely for engineering purposes (not in support of program decisions) do not need to be identified in this paragraph. The items identified in this paragraph should have an accreditation plan developed as outlined in DUSA(OR) memorandum, 30 Oct 89, Subject: Verification, Validation and Accreditation of Models.

h. Special Requirements. Discuss requirements for any significant non-instrumentation capabilities and resources such as: special data processing/data bases, unique mapping/charting/geodesy products, extreme physical environmental conditions or restricted/special use air/sea/landscapes.

i. Test and Evaluation Funding Requirements. Estimate, by fiscal year and appropriation line number (program element), the funding required to pay direct costs of planned testing. State, by fiscal year, the funding currently appearing in those lines (program elements). Identify any major shortfalls.

> Use of a table or matrix is preferred.
>
> Show potential shortfalls.

j. Manpower/Personnel Training. Identify manpower/personnel and training requirements and limitations that affect test and evaluation execution.

The preliminary Test and Evaluation Master Plan should project the key resources necessary to accomplish demonstration and validation testing and early operational assessment. The preliminary Test and Evaluation Master Plan should estimate, to the degree known at Milestone I, the key resources necessary to accomplish developmental test and evaluation, live fire test and

evaluation, and operational test and evaluation. These should include elements of the National Test Facilities Base (which incorporates the Major Range and Test Facility Base (MRTFB), capabilities designated by industry and academia, and Major Range and Test Facility Base test equipment and facilities), unique instrumentation, threat simulators, and targets. As system acquisition progresses, the preliminary test resource requirements shall be reassessed and refined and subsequent Test and Evaluation Master Plan updates shall reflect any changed system concepts, resource requirements, or updated threat assessments. Any resource shortfalls which introduce significant test limitations should be discussed with planned corrective action outlined.

> This paragraph contains overall guidance for preparing a preliminary TEMP, i.e., a TEMP to support Milestone I. It is not a separate paragraph to be addressed in the TEMP.

APPENDIX A -- BIBLIOGRAPHY

a. Cite in this section all documents referred to in the Test and Evaluation Master Plan.

b. Cite all reports documenting developmental and operational testing and evaluation.

APPENDIX B -- ACRONYMS. List and define all acronyms used in the Test and Evaluation Master Plan.

APPENDIX C -- POINTS OF CONTACT. Provide a list of points of contact as illustrated by Figure 3-10.

ANNEXES OR ATTACHMENTS. Provide as appropriate.

> An annex is written specifically for the TEMP, whereas an attachment is a stand alone document.

APPENDIX C

PROGRAM POINTS OF CONTACT (FORMAT)

NAME	ORGANIZATION (Mailing Address)	PHONE (Commercial) (DSN) (FAX) (E-mail)
Program Manager		
PEO Representative		
TIWG Members		
User Representative		

Figure 3-10. Appendix C. Points of Contact (Format)

Chapter 4
Format and Contents for Information Mission Area (IMA) Programs

Section I
Introduction.

4-1. General.

a. The format for all Army developed Major Automated Information System Review Council (MAISRC) Test and Evaluation Master Plans (TEMPs) will be in accordance with Part 7, DoD 5000.2-M.

b. DoD 5000.2-M, Part 7, attachment 1, is replicated in whole in the following sections, except as noted below. Specific content guidance appropriate for Army preparation of MAISRC TEMPs is noted in the boxed remarks following a given paragraph. Figures 4-5 and 4-6 are revised showing Army interpretation of the DOD guidance.

c. Signature Page formats and layout for programs by MAISRC decision level are provided at figures 4-1 and 4-2. Signature Page format and layout for non-MAISRC programs is provided at figure 3-5. Program element information can be obtained from the current year version of AR 37-100-XX.

d. An example of a TIWG Coordination Sheet is at figure 4-3. The TIWG Coordination Sheet should show the specific participants of a program, for example, the TIWG Chair should show the PM, program name, the functional proponent should be identified ; ISEC should be identified as the Developmental Evaluator, OEC as the Operational Evaluator, etc. Support contractor signatures are not acceptable. Spell out the name and organization of the signatory (signature block).

e. A TEMP will include a Signature Page, a TIWG Coordination Sheet as shown in figure 4-3, and an Outline as shown in figure 4-4.

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

______________________ ______
Program Manager DATE

CONCURRENCE

______________________ ______
Program Executive Officer (or Developing Agency if no PEO) DATE

______________________ ______ ______________________ ______
CDR U.S. Army Operational Test & Evaluation Command (OPTEC) DATE Functional Proponent DATE

APPROVED BY

______________________ ______
Deputy Under Secretary of the Army (Operations Research) DATE

FIGURE 4-1. Signature Page format for Army Major Automated Information System Review Committee (MAISRC) Programs

TEST AND EVALUATION MASTER PLAN
FOR
PROGRAM TITLE
SYSTEM NAME
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

Program Elements
Xxxxx
Xxxxx

****

SUBMITTED BY

______________________ ______
Program Manager DATE

CONCURRENCE

______________________ ______
Program Executive Officer (or Developing Agency if no PEO) DATE

______________________ ______ ______________________ ______
CDR U.S. Army Operational Test & Evaluation Command (OPTEC) DATE Functional Proponent DATE

COMPONENT APPROVAL

______________________ ______
Deputy Under Secretary of the Army (Operations Research) DATE

****

OSD APPROVAL

______________________ ______ ______________________ ______
Director, Operational Test and Evaluation DATE Director, Test and Evaluation Under Secretary of Defense (Acquisition) Date

FIGURE 4-2. Signature Page Format for OSD Major Automated Information System Review Committee (MAISRC) Programs

TIWG COORDINATION SHEET
TEMP FOR
PROGRAM TITLE
DATE
UPDATE XX, DATE (As applicable)
REVISION XX, DATE (As applicable)

	Signature	Date
Program Manager (TIWG Chair) (Name/Organization)	____________	CONCUR/NONCONCUR____________
Functional Proponent/ (Center/Agency)	____________	CONCUR/NONCONCUR____________
Developmental Tester (ISEC)	____________	CONCUR/NONCONCUR____________
Develop Evaluator/Assessor (ISEC)	____________	CONCUR/NONCONCUR____________
Operational Tester (TEXCOM)	____________	CONCUR/NONCONCUR____________
Operational Evaluator (OEC)	____________	CONCUR/NONCONCUR____________
Logistician	____________	CONCUR/NONCONCUR____________
Threat Integrator*	____________	CONCUR/NONCONCUR____________
Other **	____________	CONCUR/NONCONCUR____________

* Required for Theater/Tactical systems
**Include participating service representatives for multiservice programs.

FIGURE 4-3. TEMP/TIWG Coordination Sheet.

TEST AND EVALUATION MASTER PLAN OUTLINE (FORMAT)

		Page Number
PART I	SYSTEM INTRODUCTION (2 pages suggested - refer to annexes)	
a.	Mission Description	xx
b.	System Threat Assessment	xx
c.	Minimum Acceptable Operational Performance Requirements	xx
d.	System Description	xx
e.	Critical Technical Parameters (See Figure 3-10)	xx
PART II	INTEGRATED TEST PROGRAM SUMMARY (2 pages suggested)	
a.	Integrated Test Program Schedule (See Figure 3-11)	xx
b.	Management	xx
PART III	DEVELOPMENTAL TEST AND EVALUATION OUTLINE (10 pages suggested)	
a.	Developmental Test and Evaluation Overview	xx
b.	Developmental Test and Evaluation to Date	xx
c.	Future Developmental Test and Evaluation	xx
d.	Live Fire Test and Evaluation	xx
PART IV	OPERATIONAL TEST AND EVALUATION OUTLINE (10 pages suggested)	
a.	Operational Test and Evaluation Overview	xx
b.	Critical Operational Issues	xx
c.	Operational Test and Evaluation to Date	xx
d.	Future Operational Test and Evaluation	xx
PART V	TEST AND EVALUATION RESOURCE SUMMARY (6 pages suggested)	
a.	Test Articles	xx
b.	Test Sites and Instrumentation	xx
c.	Test Support Equipment	xx
d.	Threat Systems/Simulators	xx
e.	Test Targets and Expendables	xx
f.	Operational Force Test Support	xx
g.	Simulations, Models and Testbeds	xx
h.	Special Requirements	xx
i.	T&E Funding Requirements	xx
j.	Manpower/Personnel Training	xx
APPENDIX A	Bibliography	A-1
APPENDIX B	Acronyms	B-1
APPENDIX C	Points of Contact	C-1
ANNEXES/ATTACHMENTS (if appropriate)		

FIGURE 4-4. Test and Evaluation Master Plan Outline.

Section II
Format and Contents for Information Mission Area Systems

4-2. TEST AND EVALUATION MASTER PLAN CONTENT (FORMAT)

PART I -- SYSTEM INTRODUCTION

a. Mission Description. Reference the Mission Need Statement and briefly summarize the mission need described therein.

> Define the need in terms of mission, objectives and general capabilities.
>
> System capabilities are detailed in paragraph 2 and 4 of the MNS and Part 1, Section 4 of the System Decision Paper (SDP). Functional process improvement is detailed in Chapter 3 of the MNS or Part 2, Section 1 of the SDP.

b. System Threat Assessment. Reference the system threat assessment and briefly summarize the threat environment described herein.

> Not applicable for IMA unless system developed to counter a specific threat. If a STAR is prepared for the system, summarize the operational threat environment from paragraph 4c of the STAR and the system specific threat from paragraph 4e.

c. Minimum Acceptable Operational Performance Requirements.

Reference the Operational Requirements Document and summarize the critical operational effectiveness and suitability parameters and constraints (manpower, personnel, training, software, computer resources, transportation (lift), etc.) described therein.

> For systems conforming to DoD STD 7935A, operational requirements are specified in Section 2.2 of the Functional Description (FD).
>
> For systems conforming to DoD STD 2167A, operational requirements are specified in Sections 3.5.2 and 3.7-3.12 of the Software Requirements Specification (DI-MCCR-80025A)
>
> For systems using accelerated techniques and automated tools, use the High Level Functional Description (HLFD).

d. System Description. Briefly describe the system design. Include the following items:

(1) Key features and subsystems, both hardware and software (such as architecture, interfaces, security levels, reserves, etc.), allowing the system to perform its required operational mission.

(2) Interfaces with existing or planned systems that are required for mission accomplishment. Address relative maturity and integration and modification requirements for nondevelopment items. Include interoperability with existing and/or planned systems of other DoD Components or allies.

(3) Critical system characteristics (see Section 4-C of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures,") or unique support concepts resulting in special test and analysis requirements (e.g., post deployment software support, hardness against nuclear effects; resistance to countermeasures; development of new threat simulation, simulators, or targets.)

> For systems conforming to DoD STD 7935A, key features of the total system are identified in Chapter 3 B of the MNS and Section 4 of the FD. Interfaces are identified in Chapter 4 C of the MNS, Section 5.4 of the FD, and Section 3 of the System Specification.
>
> For systems conforming to DoD STD 2167A, key features of the total system are identified in Chapter 3 B of the MNS and Section 3 of the System Specification (DI-CMAN-80008A). Interfaces are identified in Section 3 of the Interface Requirements Specification (DI-MCCR-80026A).
>
> For systems conforming to both DoD STD 7935A and 2167A, unique system characteristics are identified in Chapter 4 A of the MNS.
>
> Include non developmental items or commercial-off-the-shelf software and any required interoperability with existing or planned systems or other DOD components or allies.

e. Critical Technical Parameters.

(1) List in a matrix format (see Figure 4-5) the critical technical parameters of the system (including software maturity and performance measures) that have been evaluated or will be evaluated during the remaining phases of developmental testing. Critical technical parameters are derived from the Operational Requirements Document, critical system characteristics (see Part 4 of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures") and technical performance measures (see

Section 6-A of DoD Instruction 5000.2, "Defense Acquisition Management Policies and Procedures") and should include the parameters in the acquisition program baseline (see Part 14, DoD 5000.2-M). Discuss the relationship between the critical technical parameters and the minimum acceptable operational performance requirements in the Operational Requirements Document.

(2) Next to each technical parameter, list the accompanying objectives and thresholds as illustrated by Figure 4-5.

Critical Technical Parameters	Total events	Technical objective for each test event	Location	Schedule	Decision supported	Demonstrated value
Measurable Parameter with reference	Single event or test phase	Measurable Technical value	Test facility	Test period	Milestone, in-process review or major event	(Include the Actual Value)
Maximum Query response time 15 seconds (reference)	EUT SDT SQT	20 sec 15 sec 15 sec	ABC facility DEF facility DEF facility	1Q FY-XX 2Q FY-XX 3Q FY-XX	MS II IPR MS IIIc	X Y Z

Figure 4-5. Sample Critical Technical Parameters Matrix
(This matrix depicts the evaluation criteria to assess developmental progress)

Critical Technical Parameters - obtained from the software specification and other related documents.

For systems using accelerated techniques and automated tools, critical technical parameters are derived from the HLFD and its versions as it transitions to become the Functional Description (FD).

Reference - the source from which the parameter and value is derived.

Total events - the developmental tests conducted wherein the parameters are tested. Tests should be outlined in Part III.

Technical objective for each event - the value expected to be attained at that stage of development.

Location - the place where the test will be performed.

Schedule - the fiscal quarter when the test will be initiated.

Decision Supported - the program milestone or review that will consider the results of this test.

> Demonstrated Value - state the actual value obtained from testing.
>
> A MS I (preliminary) TEMP is not expected to contain detailed requirements. The TEMP update to support Milestone II should include detailed values.

(3) Highlight critical technical parameters that must be demonstrated before entering the next acquisition or operational test phase and ensure that the actual values which have been demonstrated to date are included in the last column.

> Critical technical parameters are defined as those measurable critical system characteristics including software, that when achieved, allow the attainment of the minimum acceptable operational performance requirements. Software critical technical parameters may include language, architecture, interfaces, supportability, security levels, time, memory, and input/output reserves.
>
> For systems conforming to DoD STD 7935A, a matrix relating the critical required technical parameters may be derived from information found in the System/Subsystem Specification and Chapter 2.5 of the User's Manual.
>
> For systems conforming to DoD STD 2167A, a matrix relating the critical required technical parameters may be found in Section 3.6 of the Software Specification (DI-MCCR-80025A).

PART II -- INTEGRATED TEST PROGRAM SUMMARY

a. Integrated Test Program Schedule

(1) As illustrated in Figure 4-6, display on a chart the integrated time sequencing of the critical test and evaluation phases and events, related activities, and planned cumulative funding expenditures by appropriation.

(2) Include event dates such as milestone decision points; operational assessments, test article availability; software version releases; appropriate live fire test and evaluation, and operational test and evaluation; low rate initial production deliveries; Full Rate Production deliveries; Initial Operational Capability; Full Operational Capability; and statutorily required reports.

(3) A single schedule should be provided for multi-Service of Joint and Capstone Test and Evaluation Master Plans showing all DoD Component system event dates.

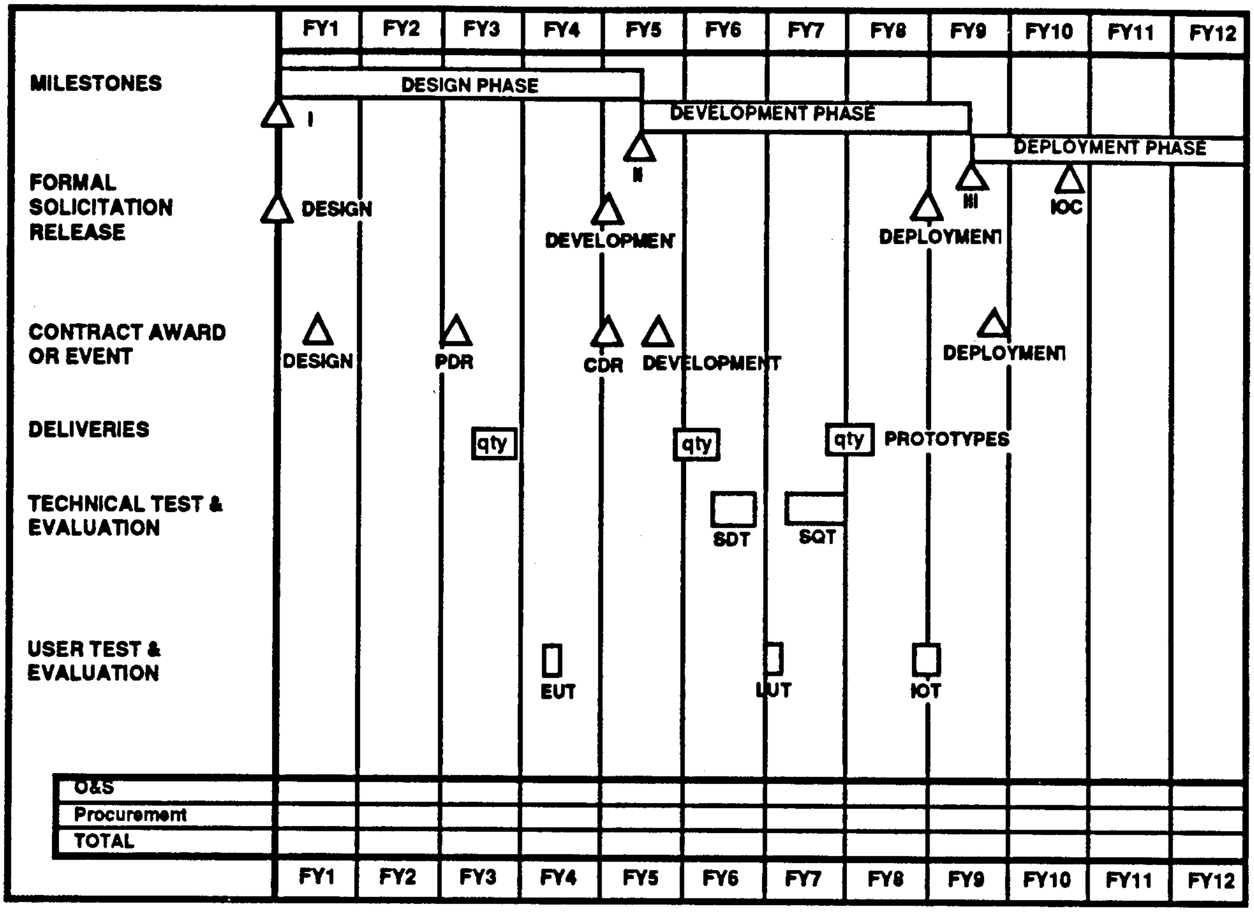

Figure 4-6. Integrated Test Program Schedule (Illustrative Example)

The integrated test program schedule will be divided into seven major areas: Program Milestones; Program Acquisition Events; Contract Release and Awards; Program Deliverables; Developmental Test and Evaluation; Operational Test and Evaluation and Program Funding. Figure 4-6 provides an illustrated example of an integrated test program.

Information/data should be obtained from the master schedule, Section F of the Management Plan (MP).

Can be a fold-out

Must cover the acquisition and test & evaluation program through full operational capability

The integrated time sequencing of critical events will be reflected as appropriate (for example):

MILESTONES: I, II, III, Initial Operational Capability (IOC)

FORMAL SOLICITATION RELEASE:

Design
Development
Deployment

CONTRACT AWARD AND EVENTS:

Design
Development
Deployment
System Software Specification (SSS)
Software Requirements Review (SRR)
Software Design Review (SDR)

DELIVERIES:

Prototype (Designate Quantity)
Production (Designate Quantity)

TECHNICAL TEST & EVALUATION (DT&E):

Pre-MS III
- Software Development Test (SDT)
- Software Qualification Test (SQT)
- Software Acceptance Test (SAT)

Deployment/Operations Phase
- Software Change Package (SCP)

USER TEST & EVALUATION (OT&E):

Early Operational Assessment
Operational Assessment

Pre-MS II
- Early User Test (EUT)
- Early User Experiment (EUE)

Pre-MS III
- Limited User Test (LUT)
- Initial Operational Test (IOT)

Deployment/Operations Phase
- Follow-on Operational Test (FOT)
- Lead Site Verification Test (LSVT)

As Required
- Supplemental Site Test

FUNDING - Cumulative by fiscal year

O&S - include all O&S expenditures, not just T&E related
- include DT&E and OT&E costs

- include Test Articles for DT&E and IOT&E
- includes OMA, OMR and OMNG

PROCUREMENT - as described in the program Baseline Agreement.

b. Management

(1) Discuss the test and evaluation responsibility of all participating organizations (developers, testers, evaluators, users).

Identify TIWG members and their role. Reference the TIWG charter for specific responsibilities. (See AR 73-1 and Part One, Chapter 8) The TIWG charter must be included as a reference in Appendix A, Bibliography. For example:

Program Manager/TIWG Chair	PM (System)
Functional Proponent	Proponent Agency
Operational Evaluator	OEC
Operational Tester	TEXCOM
Developmental Evaluator/Assessor	ISEC
Developmental Tester	ISEC
Logistician/PDSS Organization	ISSC
Threat Integrator*	TRADOC
Participating Service OTA	AFOTEC, MCOTEA, COMOPTEVFOR
Participating Service Functional Proponent (if multi-service)	

* Required for Theater/Tactical systems.

An outline of T&E responsibilities of all participating organizations is defined in Section 2 G of the Program Manager/Project Manager (PM) charter.

(2) Provide the date (fiscal quarter) when the decision to proceed beyond low-rate initial production is planned. (Low-rate initial production quantities required for operational test must be identified for the Director of Operational Test and Evaluation approval prior to Milestone II for acquisition category I programs and other acquisition category programs designated for Office of the Secretary of Defense test and evaluation oversight).

> Provide the date (fiscal quarter) when the decision to proceed to Milestone III certification is planned. If the system is being developed through an incremental acquisition strategy, 1) provide the date (fiscal quarter) when the decision to proceed to MS III C. is planned and 2) briefly outline the extent of incremental deployment activities. (prototype, test bed sites, etc.) prior to MS III C. (Extent of incremental deployment before Initial Operational Test and Evaluation must be identified prior to MS II for OSD and Army MAISRC systems).
>
> The quantity of items needed for IOT is recommended by OPTEC in coordination with the program manager and included for approval by DOT&E for programs having OSD test and evaluation oversight.
>
> The quantity of items needed for IOT for all other programs are included as recommended by OPTEC.

(3) Identify and discuss any operational issues and vulnerability and lethality Live Fire Test requirements that will not be addressed before proceeding beyond low-rate initial production.

> For incremental development programs, Milestone II is considered as equivalent to the low rate initial production (LRIP) decision point.

PART III -- <u>DEVELOPMENTAL TEST AND EVALUATION OUTLINE</u>

a. <u>Developmental Test and Evaluation Overview</u>. Explain how developmental test and evaluation will: verify the status of engineering and manufacturing development progress; verify that design risks have been minimized; and substantiate achievement of contract technical performance requirements; and be used to certify readiness for dedicated operational test. Specifically, identify:

(1) Any technology/subsystem that has not demonstrated its ability to contribute to system performance and ultimately fulfill mission requirements.

(2) The degree to which system hardware and software design has stabilized so as to reduce manufacturing and production decision uncertainties.

Summarize the entire developmental test and evaluation program.

Present a narrative walk-through of the integrated schedule, discussing the interrelationships between tests, developmental and operational, and between tests and milestones. Do not duplicate details that will be found in para 3c, Future Developmental Test and Evaluation. The purpose of the Overview is to identify how the individual tests fit within the framework of the overall program and the continuous evaluation process. Some of the topics that need to be addressed in this paragraph include:

(1) Early developmental tests that will be performed to mitigate technical risks in the program that are defined in the Risk Assessment Annex D. Integrated Program Summary (Reference DoD 5000.2-M, Part 4, Annex E.).

(2) Identification of developmental tests that will be used to demonstrate that the test item is safe, that the technical manuals are verified and validated and ready for usage in a following or concurrent Operational Test.

(3) Identification of the test, usually Software Qualification Test (SQT), that will be performed to validate that the system meets the program's technical performance requirements that are usually contractually mandated in a specification.

The following areas need to be addressed throughout Developmental Test and Evaluation (They are addressed in general in the DT&E Overview and specifically in the description, objective, etc, of each of the developmental tests addressed in Future DT&E.):

Reliability, Availability, and Maintainability (Reference DoDI 5000.2, Part 6, Section C.)

Human Factors (Reference DoDI 5000.2, Part 6, Section H)

System Safety, Health Hazards and Environment (Reference DoDI 5000.2, Part 6, Section I)

Discuss the metrics that will be used to determine software status and evaluate progress toward software maturity in support of key decision points. Show how the metrics in each phase relate to those in previous and subsequent phases.

b. Developmental Test and Evaluation to Date. Identify completed developmental test and evaluation by noting on the

matrix of critical technical parameters those parameters that have been demonstrated.

> Update the Critical Technical Parameters matrix in Part I.
>
> For parameters not met, provide a brief explanation as to why and performance impact. Identify future test that will re-address parameters.
>
> If during any prior T&E phase or event, mission critical deficiencies were identified, a discussion of the nature of each deficiency, corrective action required, or the schedule for the DT&E retest verification, should be included as derived from Section 3 of the Test Analysis report. (DI-MCCR-80017A for DoD STD 2167A)
>
> A detailed discussion of the results of testing is not required.
>
> Test and evaluation reports prepared to date must be included as references in Appendix A. Bibliography.

c. <u>Future Developmental Test and Evaluation</u>. Discuss all remaining developmental test and evaluation that is planned, beginning with the date of the current Test and Evaluation Master Plan revision and extending through completion of production. Place emphasis on the next phase of testing. For each phase, include:

> For each test within each remaining acquisition phase address the following items: configuration description, DT&E objectives, DT&E events, scope, basic scenarios and limitations e.g., (1) Development
>
> (a) Software Development Test (SDT)
> - (1) Configuration description (of test item)
> - (2) Test and Evaluation Objectives
> - (3) Events, Scope of Testing, and Basic Scenarios
> - (4) Limitations
>
> (b) Software Qualification Test (SQT)
> - (1) Configuration description (of test item)
> - (2) Test and Evaluation Objectives
> - (3) Events, Scope of Testings and Basic Scenarios
> - (4) Limitations
>
> For those critical technical parameters where demonstrated value did not meet the threshold or objective, planned testing must insure that these parameters will be re-addressed.

(1) Configuration Description. Summarize the functional capabilities of the system's developmental configuration and how they differ from the production model.

> List the difference between the system to be tested and the objective system, to include software.
>
> For systems conforming to DoD STD 7935A and 2167A, a summary of future DT&E system hardware and software functional capability and how it is expected to differ from the configuration planned for deployment may be found in the Test Plan.

(2) Developmental Test and Evaluation Objectives. State the test objectives for this phase in terms of the critical technical parameters to be confirmed. Identify any specific technical parameters which the milestone decision authority has designated as exit criteria and/or directed to be demonstrated in a given phase of testing.

> Discuss problem areas, if any, identified by the use of software metrics. Describe how future developmental test and evaluation events will measure progress toward elimination of these problem areas.

(3) Developmental Test and Evaluation Events, Scope of Testing, and Basic Scenarios. Summarize the test events, test scenarios and the test design concept Quantify the testing (i.e., number of test hours, test events, test firings). List the specific threat systems, surrogates, countermeasures, component or subsystem testing, and testbeds the use of which are critical to determine whether developmental test objectives are achieved. As appropriate, particularly if an agency separate from the test agency will be doing a significant part of the evaluation, described the methods of evaluation. List all models and simulations to be used and explain the rationale for their credible use. Describe how performance in natural environmental conditions representative of the intended area of operations (e.g., temperature, pressure, humidity, fog, precipitation, clouds, blowing dust and sand, icing, wind conditions, steep terrain, wet soil conditions, high sea state, storm surge and tides, etc.) and interoperability and compatibility with other weapon and support systems as applicable will be tested.

> The resources identified must correspond to those listed in Part V.
>
> Include discussion of any test databases and/or remote terminal emulators to be used and their relationship to the objective system environment.

(4) Limitations. Discuss the test limitations that may significantly affect the evaluator's ability to draw conclusions, the impact of these limitations, and resolution approaches.

d. Live Fire Test and Evaluation. Include a description of the overall live fire test and evaluation strategy for the item; critical live fire test and evaluation issues; required levels of system vulnerability/lethality; the management of the live fire test and evaluation program live fire test and evaluation schedule, funding plans and requirements; related prior and future live fire test and evaluation efforts; the evaluation plan and shot selection process; and major test limitations for the conduct of live fire test and evaluation. Live fire test and evaluation resource requirements (including test articles and instrumentation) will be appropriately identified in the Test and Evaluation Resource Summary.

> Generally not applicable for IMA systems, except when development includes protective shelters.

Part IV -- OPERATIONAL TEST AND EVALUATION OUTLINE

a. Operational Test and Evaluation Overview

(1) The primary purpose of operational testing and evaluation is to verify that operationally effective and operationally suitable systems are approved for production that meet the mission needs and minimum operational performance requirements of the operating forces.

(2) The Test and Evaluation Master Plan will show how program schedule, test management structure, and required resources are related to operational requirements, critical operational issues, test objectives, and milestone decision points. Testing will evaluate the system (operated by typical users) in an environment as operationally realistic as possible, including threat representative hostile forces and the expected range of natural environmental conditions.

> Summarize the entire operational test and evaluation program. Present a narrative walk-through of the integrated schedule discussing the interrelationships between contractor, government, developmental and operational tests, models and simulations and the milestones they support. Do not duplicate the details that are provided in paragraph 4.d, Future Operational Test and Evaluation. The purpose of the overview is to give a quick, concise look at the overall test program, explaining the many interrelationships and opportunities to

conduct continuous evaluation (CE). Some of the topics that need to be addressed include:

(1) Identification of contractor and developmental tests that will be used as part of an operational evaluation or assessment.

(2) Identification of simulations that will be used to augment and extend operational testing as part of an operational evaluation or assessment.

b. Critical Operational Issues

(1) List in this section the critical operational issues. Critical operational issues are the operational effectiveness and operational suitability issues (not parameters, objectives or thresholds) that must be examined in operational test and evaluation to evaluate/assess the system's capability to perform its mission.

(2) A critical operational issue is typically phrased as a question that must be answered in order to properly evaluate operational effectiveness (e.g.,"Will the system detect the threat in a combat environment at adequate range to allow successful engagement?") and operational suitability (e.g., "Will the system be safe to operate in a combat environment?").

(3) Some critical operational issues will have critical technical parameters and minimum acceptable operational performance requirements or thresholds. Individual attainment of these attributes does not guarantee that the critical operational issue will be favorably resolved. The judgment of the operational test agency is used by the DoD Component to determine if the critical operational issue is favorably resolved.

(4) If every critical operational issue is resolved favorably, the system should be operationally effective and operationally suitable when employed in its intended environment by typical users.

Functional Proponent (FP) developed and approved Critical Operational Issues and Criteria (COIC) are required for all Army and OSD MAISRC programs for MS I.

DISC4 approved COIC are required for Army and OSD MAISRC systems at MS II and beyond.

Include the approved COICs in their entirety in the TEMP; this includes Issue, Scope, Criteria and Rationale.

Reference the COIC approval document in Appendix A, Bibliography.

c. Operational Test and Evaluation to Date. Identify and date test reports that detail the results of testing and operational assessments to date. Indicate critical operational issues that were resolved (satisfactory, unsatisfactory, yes, no etc.), partially resolved, or unresolved at the completion of each phase of testing.

The results related to the resolution of the criteria in addition to the overall issue should be discussed.

Ensure that all test reports referenced are listed in Appendix A, Bibliography. Reports must be available if requested.

For software, within the context of previously identified operational issues, summarize what has been learned from the operational test accomplished to date about the maturity of the software. Show how operational test results from interim hardware and software configurations apply to configurations intended for deployment. Identify differences between tested software, software planned for the current phase, and software to be deployed. Discuss the importance of these differences.

d. Future Operational Test and Evaluation. For each remaining phase of operational test and evaluation, separately address the following:

Identify operational tests that will be conducted and the developmental tests that will be used as data for operational evaluation or assessment. When developmental tests are identified, subparagraph (3) Events, Scope of Testing and Scenarios should define the data that will be taken from the developmental test for the evaluation or assessment. This will ensure that the developmental testers and evaluators, by their signature on the TEMP, have agreed to collect and provide that data to the operational evaluator.

Describe how models will be accredited for use in this specific application. The approval vehicle for accreditation is an Accreditation Plan as outlined in DUSA(OR) memo dated 30 Oct 89, subject: Verification, Validation, and Accreditation of Models. Reference the Accreditation Plan in Appendix A, Bibliography.

Part V, Resource Summary will identify the resources necessary to perform the validation and/or accreditation.

If more than one test is in a phase, the following layout should be included for each test. For example:

(1) Development
(a) Limited User Test (LUT)
- (1) Configuration description (of test item)
- (2) Test and Evaluation Objectives
- (3) Events, Scope of Testing and Scenarios
- (4) Limitations

(Note: Either list each sub-element for the developmental test to be used for data or refer to the applicable paragraph in Part III that contains the information.)

(b) Initial Operational Test and Evaluation
- (1) Configuration description (of test item)
- (2) Test and Evaluation Objectives
- (3) Events, Scope of Testing and Scenarios
- (4) Limitations.

(1) Configuration Description. Identify the system to be tested during each phase, and describe any differences between the tested system and the system that will be fielded including, where applicable, software maturity performance and criticality to mission performance, and the extent of integration with other systems with which it must be interoperable or compatible. Characterize the system (e.g., prototype, engineering development model, production representative or production configuration)

(2) Operational Test and Evaluation Objectives. State the test objectives including the minimum acceptable operational performance requirements and critical operational issues to be addressed by each phase of operational test and evaluation and the milestone decision review(s) supported. Operational test and evaluation that supports the beyond low rate initial production decision should have test objectives that examine all areas of operational effectiveness and suitability.

Human performance issues must be addressed (Reference DoDI 5000.2, Part 7, Section B).

Discuss the relationship between OT&E objectives and the software characteristics which affect critical operational issues.

For FOT&E, identify major deficiency corrections to be verified. UTs should be designed to assure that software is fault tolerant and supportable.

(3) Operational Test and Evaluation Events, Scope of Testing, and Scenarios. Summarize the scenarios and identify the events to be conducted, type of resources to be used, the threat simulators and the simulation(s) to be employed, the type of representative personnel who will operate and maintain the system, the status of the logistic support, the operational and maintenance documentation that will be used, the environment under which the system is to be employed and supported during testing, the plans for interoperability and compatibility testing with other United States/Allied weapon and support systems as applicable, etc. Identify planned sources of information (e.g., developmental testing, testing of) related systems, modeling, simulation, etc.) that may be used by the operational test agency to supplement this phase of operational test and evaluation. Whenever models and simulations are to be used, explain the rationale for their credible use. If operational test and evaluation cannot be conducted or completed in this phase of testing and the outcome will be an operational assessment instead of an evaluation, this should clearly be stated and the reason(s) explained.

Include a description of the relationship between software functions being tested and test scenario events that will cause that function to be exercised. Identify load levels to be used and their relationship to the required operational environment.

(4) Limitations. Discuss the test limitations including threat realism, resource availability, limited operational (military, climatic, nuclear, etc.) environments, limited support environment, maturity of tested system, safety, etc., that may impact the resolution of affected critical operational issues. Indicate the impact of the test limitations on the ability to resolve critical operational issues and the ability to formulate conclusions regarding operational effectiveness and operational suitability. Indicate the critical operational issues affected in parenthesis after each limitation.

Identify any factors which may inhibit realistic OT of the software. Constraints imposed by software maturity or availability of resources and simulators should be given along with their impact on critical operational issues.

PART V -- TEST AND EVALUATION RESOURCE SUMMARY

Provide a summary (preferably in a table or matrix format) of all key test and evaluation resources, both government and contractor, which will be used during the course of the acquisition program. Specifically, identify the following test resources:

A matrix or table is preferred to identify planned use of available key assets and requirements for a new or unique capability or item that needs to be acquired or developed to support the test program. The following should be addressed:

test articles
test sites and instrumentation
test support equipment
simulations, models and testbeds

Developmental tester and operational tester should provide input specific to their requirements. Indicate which requirements were identified by each tester.

Existing capabilities that are key to accomplishing the test program need be included and specifically all those where use is known to be restricted or significant upgrade or improvement is needed.

The matrix should, at a minimum, identify the item, the quantity or number required, the location, the test event or time frame when needed, the resources required to be obtained and the organization/activity responsible for acquisition or development.

Resource requirements are found in the Management Plan (MP).

a. Test Articles. Identify the actual number of and timing requirements for all test articles, including key support equipment and technical information required for testing in each phase by major type of developmental test and evaluation and operational test and evaluation. If key subsystems (components, assemblies, subassemblies or software modules) are to be tested individually, before being tested in the final system configuration, identify each subsystem in the Test and Evaluation Master Plan and the quantity required. Specifically identify when prototype, engineering development, pre-production, or production models will be used.

b. Test Sites and Instrumentation. Identify the specific test ranges/facilities to be used for each type of testing. Compare the requirements for test ranges/facilities dictated by the scope and content of planned testing with existing and programmed test range/facility capability, and highlight any major shortfalls, such as inability to test under representative natural environmental conditions.

Identify instrumentation that must be acquired specifically to conduct the planned test program.

> This includes software facilities and tools to support testing identified in Parts III and IV.
>
> Address instrumentation that must be developed and/or procured. Clearly identify the test investment requirement.

c. Test Support Equipment. Identify test support equipment that must be acquired specifically to conduct the test program.

> Only address new test support equipment. This includes software test drivers, emulators, stimulators or diagnostics, if applicable, to support identified testing. Identify unique or special calibration requirements associated with this test support equipment.

d. Threat Systems/Simulators. Identify the type, number, availability, and fidelity requirements for all threat systems/simulators. Compare the requirements for threat systems/simulators with available and projected assets and their capabilities. Highlight any major shortfalls. Each threat simulator shall be subjected to validation procedures to establish and document a baseline comparison with its associated threat and to ascertain the extent of the operational and technical performance differences between the two throughout the simulator's life-cycle.

> Generally not applicable for IMA systems, except for Theater/Tactical systems.

e. Test Targets and Expendables. Identify the type, number, and availability requirements for all targets, flares, chaff, sonobuoys, smoke generators, acoustic countermeasures, etc., that will be required for each phase of testing. Identify any major shortfalls.

> Not applicable for IMA systems.

f. Operational Force Test Support. For each test and evaluation phase, identify the type and timing of aircraft flying hours, ship steaming days, and on-orbit satellite contacts/coverage, and other critical operating force support required.

> Include size, location and type of unit required.

g. Simulation, Models, and Testbeds. For each test and evaluation phase, identify the system simulations required, including computer-driven simulation models and hardware/software-in-the-loop testbeds. Identify the resources required to validate and certify their credible usage or application before their use.

> Include only those simulations, models and testbeds that will be used to extend testing and/or used in evaluation. This includes feeder models.

h. Special Requirements. Discuss requirements for any significant non-instrumentation capabilities and resources such as: special data processing/data bases, unique mapping/charting/geodesy products, extreme physical environmental conditions or restricted/special use air/sea/landscapes.

i. Test and Evaluation Funding Requirements. Estimate, by fiscal year and appropriation line number (program element), the funding required to pay direct costs of planned testing. State, by fiscal year, the funding currently appearing in those lines (program elements). Identify any major shortfalls.

> Use of a table or matrix is preferred.
>
> Show potential shortfalls.

j. Manpower/Personnel Training. Identify manpower/personnel and training requirements and limitations that affect test and evaluation execution.

The preliminary Test and Evaluation Master Plan should project the key resources necessary to accomplish demonstration and validation testing and early operational assessment. The preliminary Test and Evaluation Master Plan should estimate, to the degree known at Milestone I, the key resources necessary to accomplish developmental test and evaluation, live fire test and evaluation, and operational test and evaluation. These should include elements of the National Test Facilities Base (which incorporates the Major Range and Test Facility Base (MRTFB), capabilities designated by industry and academia, and Major Range and Test Facility Base test equipment and facilities), unique instrumentation, threat simulators, and targets. As system acquisition progresses, the preliminary test resource requirements shall be reassessed and refined and subsequent Test and Evaluation Master Plan updates shall reflect any changed system concepts, resource requirements, or updated threat assessments. Any resource shortfalls which introduce significant test limitations should be discussed with planned corrective action outlined.

This paragraph contains overall guidance for preparing a preliminary TEMP, i.e., a TEMP to support Milestone I. It is not a separate paragraph to be addressed in the TEMP.

APPENDIX A -- BIBLIOGRAPHY

a. Cite in this section all documents referred to in the Test and Evaluation Master Plan.

b. Cite all reports documenting developmental and operational testing and evaluation.

APPENDIX B -- ACRONYMS. List and define all acronyms used in the Test and Evaluation Master Plan.

APPENDIX C -- POINTS OF CONTACT. Provide a list of points of contact as illustrated by Figure 4-7.

ANNEXES OR ATTACHMENTS. Provide as appropriate.

An annex is written specifically for the TEMP, whereas an attachment is a stand alone document.

APPENDIX C

PROGRAM POINTS OF CONTACT (FORMAT)

NAME	ORGANIZATION (Mailing address)	PHONE (Commercial) (DSN) (FAX) (E-mail)
Program Manager		
PEO Representative		
TIWG Members		
User Representative		

Figure 4-7. Appendix C. Points of Contact (Format)

Chapter 5
TEMP Checklist

The checklist is intended as a guide to both TEMP developers and TEMP reviewers. The checklist when properly used should ensure that all necessary and appropriate requirements in the approved test and evaluation strategy are adequately considered and efficiently addressed in test and evaluation planning and program execution.

PROGRAM____

CURRENT TEMP MILESTONE________ DATE OF REVIEW________________

REVIEWED BY____________________________________

	Yes	No	N/A
Signature Page			
a. Does the page contain the necessary signatures for the acquisition category of the program?	___	___	___
b. Is a date at the top of the page?	___	___	___
c. Is there a update number, if this is not an initial submission?	___	___	___
d. Is there a revision number if this version contains changes based comments from HQDA and/or OSD on reviews?	___	___	___
TIWG COORDINATION SHEET			
Are there signature blocks for:			
Program Manager	___	___	___
Combat Developer	___	___	___
Developmental Tester	___	___	___
Tech Evaluator/Assessor	___	___	___
Operational Tester	___	___	___
Operational Evaluator	___	___	___
Logistician	___	___	___
Threat Integrator	___	___	___
Others as required	___	___	___
Part I. System Introduction			
a. Mission Description.			
(1) Mission of the deployed system briefly described?	___	___	___
(2) Does the mission description agree with the Mission Need Statement (MNS) and/or Operational Requirements Document (ORD)?	___	___	___
(3) Is the need defined in terms of mission, objectives, and general capabilities?	___	___	___

(4) Is the Mission Need Statement (MNS) referenced in the Appendix A - Bibliography? ___ ___ ___

b. System Threat Assessment.

(1) Is the system threat briefly described? ___ ___ ___

(2) Is the operational threat environment summarized from the STAR? ___ ___ ___

(3) Is the threat at IOC, follow-on at IOC plus 10 and the reactive threat listed? ___ ___ ___

(4) Is the STAR referenced in Appendix A - Bibliography? ___ ___ ___

c. Minimum Acceptable Operational Performance Requirements.

(1) Are the critical operational effectiveness and suitability parameters and constraints summarized from the ORD? ___ ___ ___

(2) Is the ORD referenced in Appendix A - Bibliography? ___ ___ ___

d. System Description.

(1) System design briefly described? ___ ___ ___

(2) Key features both hardware and software and subsystems allowing the system accomplishment of operational mission described? ___ ___ ___

(3) Interfaces with existing or planned systems that are required for mission accomplishments described? ___ ___ ___

(4) Are critical characteristics of the system or unique support concepts resulting in special test and evaluation requirements listed? ___ ___ ___

(5) System software, if used, described? ___ ___ ___

(6) Are existing and/or planned systems of other DoD Components or allies for which interoperability with this end item is required listed? ___ ___ ___

(7) Has the description of the overall system included Mission Critical Computer Resources (MCCR) for software utilized by the system? ___ ___ ___

(8) Have key processors, software (including firmware) configuration items, system ___ ___ ___

interfaces, internal and external message standards and protocols been identified?

e. Critical Technical Parameters.

(1) Critical technical parameters that have been/will be evaluated during all phases of development listed in the matrix? ___ ___ ___

(2) Accompanying technical threshold listed next to each technical parameter? ___ ___ ___

(3) Are results from developmental test addressing a given parameter posted? ___ ___ ___

Part II. Integrated Test Program Summary

a. Integrated Test Program.

(1) Is an integrated test program presented for the seven major areas of interest? ___ ___ ___

MILESTONES ___ ___ ___
ACQUISITION EVENTS ___ ___ ___
CONTRACT AWARDS AND EVENTS ___ ___ ___
DELIVERIES ___ ___ ___
TECHNICAL TEST AND EVALUATION ___ ___ ___
LIVE FIRE TEST AND EVALUATION ___ ___ ___
USER TEST AND EVALUATION ___ ___ ___

(2) Does the funding data correspond to programmatic forecasts and contain all categories of funding as described in chapter 8, AR 73-XX? ___ ___ ___

(a) MRTFB Reimbursable identified? ___ ___ ___
(b) RDTE identified? ___ ___ ___
(c) Procurement identified? ___ ___ ___

b. Management.

(1) T&E responsibilities of all participating organizations outlined? ___ ___ ___

(2) Is the TIWG charter referenced in Appendix A - Bibliography? ___ ___ ___

(3) Is a clear definition of LRIP and full-rate production provided? ___ ___ ___

(4) Is the date when the decision to proceed beyond LRIP provided? ___ ___ ___

(5) Have participating organizations responsible for software T&E been identified? ___ ___ ___

(7) Vulnerability and lethality Live Fire Test requirements and operational issues that cannot be addressed before proceeding beyond LRIP explanation provided? ___ ___ ___

(8) Are responsibilities for configuration management of test articles designated? ___ ___ ___

(9) Are responsibilities for establishing HUC designated? ___ ___ ___

(10) Is the HUC determination that further review not required documented here and document listed in Appendix A - Bibliography? ___ ___ ___

(11) Do the quantities required for DT&E and IOT&E correspond to those quantities designated in PART V? ___ ___ ___

Part III. Developmental Test and Evaluation Outline

a. Developmental Test and Evaluation (DT&E) Overview.

(1) Explanation included of how planned DT&E will verify:

Status of engineering design and development ___ ___ ___

Design risks have been minimized ___ ___ ___

Achievement of technical performance ___ ___ ___

Readiness for IOT ___ ___ ___

(2) Are technologies identified which have not been demonstrated? ___ ___ ___

(3) Is the degree to which the system has stabilized been addressed? ___ ___ ___

(4) Has a discussion of the indicators that will be used to determine software status and evaluate progress toward software maturity in support of key decision points been identified? ___ ___ ___

(5) Is a narrative walkthrough of the integrated schedule discussing the interrelationships between tests, developmental, and operational, and between tests and milestones presented? ___ ___ ___

(6) Are early developmental tests scheduled ___ ___ ___

which will mitigate the technical risks identified in the Integrated Program Summary, Annex D?

(7) Is the Integrated Program Summary referenced in Appendix A - Bibliography? ___ ___ ___

(8) Are developmental tests, that feed into operational tests or evaluations, identified? ___ ___ ___

(9) Are tests, that validate supportability requirements (i.e., TMs and support packages) identified? ___ ___ ___

(10) Is the test, that will validate the program's requirements against the system specification, identified? ___ ___ ___

(11) Has survivability/lethality testing been highlighted? ___ ___ ___

b. Developmental Test and Evaluation to Date.

(1) Are the demonstrated technical parameters annotated on critical technical characteristics matrix? ___ ___ ___

(2) Reports attesting to this identified in Appendix A - Bibliography? ___ ___ ___

(3) Are critical software technical parameters addressed by developmental test and evaluation annotated on the Critical Technical Parameters Matrix in Part I? ___ ___ ___

c. Future Developmental Test and Evaluation.

(1) Are developmental tests designated which will demonstrate test item safety; supportability (i.e., verify and validate technical manuals and support packages) and that specifications are met? ___ ___ ___

(2) Are survivability/lethality testing as well as those tests addressing: E^3 (Electromagnetic Environment Effects) conventional weapon effects, ECM, ECCM, initial nuclear weapon effects, advanced technology survivability, and NBC contamination identified? ___ ___ ___

(3) Are test plans and strategies to validate the manufacturing process identified? ___ ___ ___

(4) Are the following areas addressed ___ ___ ___

throughout the DT&E:

RAM	___	___	___
Survivability	___	___	___
Electromagnetic Capability	___	___	___
Human Factors	___	___	___
System Safety	___	___	___
Health Hazards	___	___	___
Environment	___	___	___
Integrated Logistical Support	___	___	___

(5) Is each test presented in the following format: Configuration Description; DT&E Objectives; DT&E Events, Scope, Basic Scenario, and Limitations? ___ ___ ___

(6) Are the differences between the system to be tested and objective system stated for each test? ___ ___ ___

(7) Are the resources required for each test identified in PART V? ___ ___ ___

(8) Are test and evaluation related exit criteria identified in the Acquisition Decision Memorandum (ADM), addressed? ___ ___ ___

(9) Are test limitations that significantly affect the developmental evaluation discussed to include software developmental testing or those developmental tests which will incorporate the systems embedded software? ___ ___ ___

(a) Configuration Management:

Have the differences between software functional capabilities of the system to be tested and those of the objective system been identified? ___ ___ ___

(b) DT&E Objectives:

Have software test objectives for this phase of testing been stated? ___ ___ ___

Has the method for software evaluation been discussed? ___ ___ ___

(c) DT&E Events, Scope of Testing and Basic Scenarios:

Have the key planned software development events been identified? ___ ___ ___

Is there a discussion of the analysis, simulations, subsystem tests, and testbeds which are to be used in determining if software DT&E objectives are met? ___ ___ ___

Is there a discussion on software test limitations that may significantly affect the evaluator's ability to draw conclusions and make recommendations concerning software technical parameters? ___ ___ ___

d. Live Fire Test and Evaluation.

(1) Overall LFT&E strategy reflected? ___ ___ ___

(2) LFT&E issues identified? ___ ___ ___

(3) Required levels of system vulnerability /lethality reflected? ___ ___ ___

(4) Management of LFT&E program identified? ___ ___ ___

(5) LFT&E schedule reflected? ___ ___ ___

(6) Funding identified? ___ ___ ___

(7) Test plans identified? ___ ___ ___

(8) Requirements reflected? ___ ___ ___

(9) Related prior and future LFT&E efforts identified? ___ ___ ___

(10) Evaluation plan identified? ___ ___ ___

(11) Shot selection process reflected? ___ ___ ___

(12) Major test limitations identified? ___ ___ ___

Part IV. Operational Test and Evaluation (OT&E) Outline

a. Operational Test and Evaluation Overview.

(1) Relationship between program schedule, etc., and system requirements, operational issues, etc., reflected? ___ ___ ___

(2) OT evaluation identified? ___ ___ ___

(3) DT to be used as part of operational evaluation identified? ___ ___ ___

(4) Simulations/models that will be used to ___ ___ ___

augment OT&E reflected?

b. Critical Operational Issues.

Approved critical operational issues listed? ___ ___ ___

Reference made to approved COICs in Appendix A? ___ ___ ___

c. Operational Test and Evaluation to Date.

(1) Each phase of completed OT&E reflected? ___ ___ ___

(2) System tested identified? ___ ___ ___

(3) Summary of testing that occurred reflected? ___ ___ ___

(4) Is a summary of what has been learned as a result of OT&E about the hardware/software maturity been discussed? ___ ___ ___

(5) Are the differences between the tested hardware/software, hardware/software planned for the current phase, and hardware/software to be deployed and the importance of these differences been discussed? ___ ___ ___

d. Future Operational Test and Evaluation.

Evaluations/assessments listed as well as tests? ___ ___ ___

(1) Configuration Description

Are differences described between tested system and the system to be fielded? ___ ___ ___

Is the extent of integration with other systems reflected? ___ ___ ___

Is the system characterized? ___ ___ ___

Has the software and hardware configuration for each test been identified? ___ ___ ___

Has the degree to which test results from this configuration represent performance of the deployed system been identified? ___ ___ ___

(2) OT&E Objectives

Are test objectives including the critical operational issues to be addressed by each phase ___ ___ ___

of OT&E and the decision milestone(s) stated?

If a beyond LRIP decision is being supported are test objectives that examine all areas of operational effectiveness and suitability reflected? ___ ___ ___

Has the relationship between OT&E objectives and software characteristics which affect critical operational issues been addressed? ___ ___ ___

(3) OT&E Events, Scope of Testing, and Scenarios

Scenarios summarized? ___ ___ ___

Events to be conducted identified? ___ ___ ___

Type of resources to be used reflected? ___ ___ ___

Simulation(s)/models to be employed identified? ___ ___ ___

Type of representative personnel who will operate and maintain the system reflected? ___ ___ ___

Status of the logistic support reflected? ___ ___ ___

Operational and maintenance documentation that will be used identified? ___ ___ ___

Environment under which the system is to be employed and supported during testing reflected? ___ ___ ___

Planned sources of information reflected? ___ ___ ___

Has the relationship between software functions being tested and test scenarios been discussed? ___ ___ ___

Have load levels to be used and their relationship to the required operational environment been identified? ___ ___ ___

(4) Limitations

Are test limitations discussed that may impact the resolution of affected critical operational issues? ___ ___ ___

Are critical operational issues affected indicated in parenthesis after each limitation? ___ ___ ___

Have the identification of any factors which may inhibit realistic OT of the hardware/ software been identified? ___ ___ ___

Have constraints been identified along with their impact on critical operational issues which impose on software maturity or availability of resources and simulators? ___ ___ ___

Part V. Test and Evaluation Resource Summary

Is a summary of all key T&E resources (government and contractor) provided? ___ ___ ___

Are Major Range and Test Facility Base resources identified? ___ ___ ___

a. Test Articles.

1) Are actual number and timing requirements listed? ___ ___ ___

(2) Are key subsystems to be tested separately and their quantities identified? ___ ___ ___

(3) Are prototype, development pre-production or production model use identified? ___ ___ ___

b. Test Site and Instrumentation.

(1) Are specific test range/facility needs identified? ___ ___ ___

(2) Are planned test range/facility needs identified as compared with existing and programmed capabilities? ___ ___ ___

(3) Are new instrumentation acquisitions specified? ___ ___ ___

c. Test Support Equipment.

(1) Is specifically acquired equipment identified? ___ ___ ___

(2) Are unique/special calibration requirements indicated? ___ ___ ___

d. Threat Systems/Simulators.

(1) Type/number/availability identified? ___ ___ ___

(2) Are requirements identified as compared ___ ___ ___

with available and projected assets and their capabilities?

(3) Major shortfalls identified? ___ ___ ___

(4) Use Accredited? ___ ___ ___

e. Test Targets and Expendables.

(1) Type/number/availability identified for each phase of testing? ___ ___ ___

(2) Major shortfalls identified? ___ ___ ___

(3) Threat targets for LFTE identified? ___ ___ ___

(4) Threat munitions/systems for LFT identified? ___ ___ ___

f. Operational Force Test Support.

Type and timing of aircraft flight hours, etc., identified for each phase? ___ ___ ___

g. Simulations, Models and Testbeds.

(1) System simulations required identified for each phase? ___ ___ ___

(2) Rationale for usage/application explained? ___ ___ ___

(3) Accreditation Plan prepared? ___ ___ ___

h. Special Requirements.

Significant non-instrumentation capabilities and resources discussed? ___ ___ ___

i. Test and Evaluation (T&E) Funding Requirements.

(1) FY and appropriation line number reflected? ___ ___ ___

(2) Funding required to pay direct costs identified? ___ ___ ___

(3) Funding currently appearing in those lines indicated? ___ ___ ___

(4) Major shortfalls identified? ___ ___ ___

j. Manpower/Personnel Training

Limitations that affect test execution identified? ___ ___ ___

Appendix A - Bibliography

Reports documenting developmental and operational T&E reflected? ___ ___ ___

Appendix B - Acronyms ___ ___ ___

Appendix C - Points of Contact ___ ___ ___

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DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART THREE

CRITICAL OPERATIONAL ISSUES AND CRITERIA

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Part Three
Critical Operational Issues and Criteria (COIC)

Chapter 1
Introduction

Section I
General

1-1. COIC Objectives
Critical Operational Issues and Criteria (COIC) provide operational focus for materiel and automated information system development/acquisition milestone decisions, and serve to prioritize the undergirding operational evaluation effort. COIC development and processing objectives are to deliver an approved set of COIC which:

a. Provide operationally meaningful and relevant concerns and standards key to the Milestone III (full production) decision to focus the supporting independent operational evaluation and foster coordination among PM/MATDEV, CBTDEV, and operational evaluator.

b. Are available in a timely manner to support the Test and Evaluation Master Plan (TEMP) process.

c. Conform to the needs of the materiel acquisition decision review members and authorities, as well as, the expectations of COIC and TEMP approval authorities.

1-2. Background

a. Prior to 1985, COIC, even though developed by the combat developer (CBTDEV), were a part of the operational evaluation planning process, wherein the operational issues addressed each component of operational effectiveness (e.g., equipment, software, and/or system mission capability, survivability, interoperability, etc.) and operational suitability (e.g., reliability, availability, and maintainability (RAM), logistics supportability, training, manpower and personnel integration (MANPRINT), safety, etc.) as applicable. The CBTDEV designated with an asterisk (*), from among the total body of operational issues, those considered to be critical. While some consideration was obviously given to critical issue selection (regulations mandated many areas as critical), no specific consideration was given to the designation of critical criteria and all were therefore considered critical. This produced COIC sets with numerous issues and criteria.

b. In September 1985, after several "lessons learned" experiences with systems undergoing acquisition, HQDA changed its

COIC philosophy. COIC were to be few in number, encompass the total system, focus on the system mission, be operationally relevant, and be realistic (to system maturity) for the supported decision. They were not to deal with the myriad elements/components of operational effectiveness and suitability. It was thus hoped that a system capable of satisfying its essential operational needs/expectations would have a fair chance of moving forward in the acquisition process. The 1985 COIC philosophy continues today, with further lessons learned applied to mature the process.

1-3. Philosophy and content

a. Philosophy. Critical Operational Issue and Criteria (COIC) are those decision maker key operational concerns, with bottom line standards of performance, which if satisfied, signify the system is operationally ready to proceed into full production during the acquisition decision (normally Milestone III but may be Engineering Change Proposal [ECP] or Modification Work Order [MWO] authorization decision for modifications). COIC are not pass/fail absolutes but are show stoppers such that a system falling short of the criteria will not proceed into full production unless convincing evidence of its operational effectiveness and suitability is provided the decision makers/authorities.

b. Focus and timing. COIC are initially prepare and approved for inclusion in the Test and Evaluation Master Plan (TEMP) approved prior to Milestone I. These initial COIC are based on the Mission Needs Statement (MNS), initial Operational Requirement (ORD) (Functional Description (FD) for Automated Information Systems (AIS), and initial Cost and Operational Effectiveness Analysis (COEA) with other documentation when needed. The COIC are updated and approved based on the updated ORD and COEA for inclusion in the TEMP approved for the Milestone II. COIC continually focus on the full production decision; therefore revision subsequent to Milestone II is only necessary for significant program redirection, preplanned block upgrades, and other modification responding to revised operational requirement. The issues will be based on the MNS and should remain stable during the acquisition process. The criteria reflect the maturity of the operational requirement (ORD, FD, and COEA); therefore, they may be soft initially (Milestone I TEMP) but will be firm standards of performance for the Milestone II TEMP. Performance exit criteria with appropriate operational considerations may be used to guide the intermediate milestone decisions (e.g., Milestone II and Low Rate Initial Production (LRIP)). Such exit criteria will be documented in the TEMP but not as part or the COIC.

c. Structure. COIC are prepared in sets which include the issues; for each issue, a scope, appropriate criteria, and rationale; and applicable notes.

(1) Critical Operational Issue (COI). Those key operational concerns, expressed as questions which, when answered completely and affirmatively, signify that a system or materiel change is operationally ready to transition to full production.

(2) Scope for the issue. A statement of the operational capabilities, definitions, and conditions which focus the issue and guide its evaluation.

(3) Criteria for the issue. Those measures of performance which, when achieved, signify that the issue has been satisfied for the milestone supported.

(4) Rationale for the criteria. Justification for COIC criteria and an audit trail of their link to the operational requirement (MNS/ORD/Required Operational Capability [ROC]/FD and the COEA).

(5) Notes for the COIC. Both mandatory and system peculiar notes apply. The mandatory notes are modified to be appropriate for the system.

Section II
Organizational Functions

1-4. General

The functions of key HQDA Staff and Army components relative to COIC are outlined below. NOTE: The parenthetical () expression following a listed function identifies the staff element, agency/activity, or subordinate element which performs the function.

1-5. Headquarters, Department of the Army (HQDA)

a. Establishes and administers Army T&E policy, including COIC policy. (DUSA(OR))

b. Develops and coordinates Army COIC policy and procedures for materiel systems and Theater/Tactical (T/T) Information Mission Area (IMA) systems. Approves and distributes COIC procedures for these systems. (DCSOPS, ADCSOPS-FD/DAMO-FDR)

c. Develops and coordinates Army COIC policy and procedures for S/SB IMA systems. Approves and distributes COIC procedures for these systems. (DISC4, VDISC4/SAIS-AE)

d. Incorporates appropriate COIC policy and procedures in Army regulations and pamphlets governing T&E, materiel acquisition, and operational need/requirements definition and documentation. (TEMA, SARDA, and DCSOPS)

e. Provides the interface between DA and OSD on T&E policy matters, including COIC policy and system specific T&E documentation (TEMP, Operational T&E [OT&E] Plan [TEP], OT&E reports, and DOT&E reports to Congress). (DUSA(OR)/TEMA)

f. Maintains and distributes a schedule reflecting due dates for TEMP delivery to HQDA and OSD for approval (included are last approval date(s) for the TEMP and the following documents which support TEMP submission: STAR, MNS, ORD/ROC, and COIC). (TEMA)

g. Distributes DA and OSD responses (approval, disapproval, or comments) on Army TEMPs - provides copies of those dealing with COIC to DCSOPS, DISC4, and TRADOC. (TEMA)

h. Approves COIC for inclusion in materiel and T/T IMA systems Milestone II TEMPs which require DA or OSD approval. Included are TEMPs for ACAT I and II materiel systems, T/T MAISRC IMA systems, ACAT III and IV materiel systems and T/T IMA systems on the OSD T&E oversight list, other systems chosen by DA, and developmental modifications to these systems. (ADCSOPS-FD)

i. Approves COIC for all Category 2 through 5 S/SB IMA systems. (VDISC4)

j. Coordinates and staffs COIC within HQDA, schedules and coordinates COIC approval briefings within DCSOPS and DISC4, and distributes approved COIC. (DAMO-FDR/SAIS-AE)

k. Reviews TEMPs submitted to DA for approval for inclusion of DA approved COIC. (DAMO-FDR/SAIS-AE)

1-6. Combat Developer (CBTDEV)

a. Develops COIC for assigned materiel systems (ACAT I through IV) and T/T IMA systems in coordination with the operational evaluator, appropriate COEA analyst, Program/Project/ Product Managers (PM), and materiel and software developers. (TRADOC School/Center/ Subordinate Command CBTDEV or TRADOC System Manager (TSM)).

b. Coordinates COIC for assigned materiel and T/T IMA systems with Operational Test and Evaluation Command (OPTEC), the PM/MATDEV, software developer (SFTDEV), DAMO-FDR, and others as required to establish an approval recommendation. (HQ TRADOC System Staff Officer (TRASSO) for those systems requiring DA/OSD TEMP approval; School/ Center CBTDEV for others)

c. Approves and distributes COIC for assigned ACAT III and IV materiel and Category 5 T/T IMA systems not on the OSD T&E oversight list (includes developmental modifications to these systems). (TRADOC Center/School Commander, Commandant, or Assistant Commandant)

d. Approves and distributes COIC for inclusion in the Milestone I TEMP (includes program redirection between Milestones I and II) for those assigned materiel and T/T IMA systems requiring DA/OSD TEMP approval (includes developmental modifications to these systems). (HQ TRADOC DCSCD)

e. Approves and submits COIC to HQDA (DAMO-FDR), through Commander OPTEC (CSTE-ZA), for approval by ADCSOPS-FD for inclusion in the Milestone II TEMP for those materiel and T/T IMA systems requiring DA/OSD TEMP approval.

f. Prepares and briefs the ORD-COIC Crosswalk Horse Blanket to obtain ADCSOPS-FD approval of COIC for which he is the approval authority. Appendix E discusses preparation of the Horse Blanket. (TRADOC Center/School/Subordinate Command CBTDEV or TSM)

g. Attends the DA ADCSOPS COIC approval briefings. (HQ TRADOC TRASSO, TSM, and TRADOC Center/School Subordinate Command CBTDEV)

h. Assists the PM/MATDEV/SFTDEV during development of per-performance exit criteria by providing applicable operational considerations. (TRADOC Center/School CBTDEV or TSM)

1-7. Functional Proponent for Strategic and Sustaining Base (S/SB) Information Management Area (IMA) Systems

a. Develops COIC for assigned Category 2 through 5 S/SB IMA systems in coordination with the operational evaluator and the PM/SFTDEV.

b. Submits approved COIC to HQDA (SAIS-AE) for VDISC4 approval.

c. Prepares COIC-MNS relationship briefing and briefs to VDISC4 to obtain approval.

1-8. Operational Test and Evaluation Command (OPTEC)/Operational Evaluation Command (OEC)

a. Advises CBTDEV proponent, IMA Functional Proponent (FP), and HQDA whether COIC are testable, measurable, or otherwise evaluatable and provides appropriate structure for the operational evaluation. (OPTEC/OEC)

b. Reviews proposed COIC during CBTDEV proponent/FP development and approval processing. (OPTEC/OEC)

c. Endorses COIC from CBTDEV to HQDA. (CG OPTEC)

d. Participates during DA (ADCSOPS-FD and DISC4) approval briefings. (OPTEC/OEC)

e. Includes TRADOC approved COIC in Test and Evaluation Plan (TEP) and Part IV of the TEMP. (OEC)

f. Assists the MATDEV and CBTDEV in formulation of Milestone (MS) II and Low Rate Initial Production (LRIP) performance exit criteria. (OPTEC/OEC)

1-9. Materiel Developer (MATDEV)

a. Advises CBTDEV/FP whether COIC criteria are consistent with contract specifications and reflect appropriate materiel and software maturity expectations at the full production decision point.

b. Reviews proposed COIC during CBTDEV/FP development and approval process and participates during DA (ADCSOPS-FD/DISC4) approval briefings.

c. Incorporates complete set of approved COIC in TEMP Part IV, Paragraph 4B.

d. Formulates, in conjunction with the IOE and CBTDEV, performance oriented exit criteria for MS II and LRIP decision reviews and document as appropriate in the TEMP.

1-10. Software Developer (SFTDEV)

a. Advises CBTDEV/FP whether COIC criteria are consistent with contract specifications and reflect appropriate materiel and software maturity expectations at the full production decision point.

b. Reviews proposed COIC during CBTDEV/FP development and approval process and participates during DA (ADCSOPS-FD/DISC4) approval briefings.

c. Incorporates complete set of approved COIC in TEMP Part IV, Paragraph 4B.

Chapter 2
COIC Development and Approval Processes

Section I
General

2-1. COIC applicability

a. Materiel acquisition programs. COIC are required for all materiel system acquisition programs, developmental and nondevelopmental. COIC are also required for system preplanned block improvements and materiel changes engendered by changes to the requirements document (ROC/ORD).

b. Information Mission Area (IMA) systems acquisitions. COIC are required for all Category 2 through 5 automated information system (AIS) acquisitions in Information Mission Area (IMA). COIC are also required for preplanned block improvements for these systems and for software changes in response to changes to the requirements document (MNS). NOTE: Category 1 IMA systems are handled as major materiel system acquisitions; Category 6 IMA systems are exempt from TEMP development, and thus COIC, requirements.

c. Non-acquisition decision test and evaluation. COIC <u>are not</u> applicable to other than operational test and evaluation supporting materiel and IMA systems acquisition decision . Thus, TRADOC Force Development Evaluation (FDEV) including Force Development Test and Experimentation (FDTE) and the Concept Evaluation Program (CEP) do not require COIC. OPTEC may use data from such tests and evaluations as another data source for evaluation satisfaction of the COIC. TRADOC and other CBTDEV and training developers use a set of Operational Issues and Criteria (OIC), similar to Additional Operational Issues and Criteria (AOIC) described in paragraph 3-4 of this Part, for these evaluations.

2-2. COIC and the materiel acquisition process
The relationship of COIC to the materiel acquisition process is graphically depicted in Figure 2-1. Similar relationships apply for the AIS acquisition process.

*******INSERT FIGURE 2-1********

a. COIC development and purpose. The CBTDEV proponent/FP produces COIC as a basis for subsequent determination by appropriate DoD/Army decision authority that a system is operationally ready for full production. Critical Operational

Issues (COI), based on the Mission Need Statement (MNS), are developed for inclusion in the MS I TEMP. In that they are based on the MNS, they seldom change. COI are qualified by criteria focused on the full production (MS III) decision. These are based on the Operational Requirements Document (ORD), Cost and Operational Effectiveness Analysis (COEA), and other studies that occur throughout the process. They are thus subject to change and/or progressively increasing stringency as the system matures. COIC are included in the system TEMP, used to guide the MATDEV/SFTDEV formulation of performance oriented milestone decision review exit criteria, and form the basic structure of the evaluation effort.

b. COIC coordination. The CBTDEV Proponent/TRASSO/FP staff and coordinate COIC at applicable command levels (e.g., TRADOC and DA) with the MATDEV and with the operational evaluator.

c. COIC approval authorities.

(1) The ADCSOPS-FD approves ACAT I, II, and OSD T&E Oversight system COIC for inclusion in the MS II TEMP and all COIC revisions thereafter to focus the operational evaluation supporting the full production (Milestone III) decision for materiel systems and theater/tactical Major Automated Information Systems (MAIS).

(2) The VDISC4 approves COIC at the DA level for S/SB IMA systems.

(3) CBTDEV Command (HQ TRADOC) approves ACAT I, II, and OSD T&E Oversight system COIC for inclusion in the MS I TEMP, changes to these COIC resulting between MS I and MS II not intended for the MS II TEMP (e.g., before final ORD approval), and COIC for all ACAT III and IV materiel and Category 5 Theater/Tactical AIS not on the OSD T&E Oversight List.

2-3. Synchronized ORD, COIC, and TEMP schedules
Tables 2-1 through 2-3 provide COIC process synchronization schedules for materiel acquisition and IMA systems. They should be used by PM/MATDEV/SFTDEV, operational evaluator, and CBTDEV/FP for planning and management of these events during acquisition programs to minimize the chance of milestone decision review (MDR) delay.

a. Materiel acquisition and T/T IMA systems MS I and II. Table 2-1 provides COIC processing deadlines synchronized with those of the ORD and TEMP events. <u>For ACAT ID programs, add 15 days to the figures indicated for ACAT IC</u>.

*********INSERT TABLE 2-1***************

b. Materiel acquisition and T/T IMA system post MS II COIC changes. Table 2-2 provides a similar schedule with adjustments which apply in the event COIC require update after MS II. NOTE that timing is keyed to DA approval of the TEMP and not a specific MDR.

*********INSERT TABLE 2-2****************

c. Strategic/sustaining base (S/SB) IMA systems. Table 2-3 provides COIC/TEMP deadlines for S/SB IMA systems keyed to MDR I. Subsequent updates would follow similar schedules synchronized with TEMP delivery suspense or decision milestone schedule as appropriate.

*********INSERT TABLE 2-3****************

Section II
COIC Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA ADCSOPS-FD Approval (Figures 2-2 through 2-7)

2-4. Forward
Detailed procedures for development, review, and approval of COIC for ACAT I/II materiel, T/T MAISRC AIS, OSD T&E Oversight, and other systems selected for approval by HQDA (ADCSOPS-FD) are described on the following pages in the form of descriptive paragraphs on one page and corresponding flow chart elements on the facing page. Procedures also apply to COIC changes necessitated by developmental modifications to these system. <u>Reflected Not Later Than (NLT) dates are minimum deadlines to allow on schedule delivery of the TEMP. Managers should therefore establish appropriate internal suspenses and effect early submission where possible to ensure compliance.</u> Dotted/ dashed boxes and lines in the figures are information events/blocks. When appropriate, "NOTES" are added to highlight actions called for in the paragraph or to provide some other insight into the action required.

2-5. CBTDEV proponent drafts COIC for MS I TEMP (Figure 2-2)

a. Front end analysis. The process begins with the CBTDEV proponent conducting COIC front-end (comparative) analysis. This analysis uses as its base the MNS approved at Milestone 0 and draws from the subsequent ORD formulation process. Additional considerations include, but are not necessarily limited to: baseline intelligence products (or the System Threat Assessment Report (STAR), if available); system critical mission(s) and function(s); system employment and sustainment concepts; similar system(s) acquisition experience; studies/analyses used to justify the system requirement; the (COEA), when available; and

recent COIC approval process experiences (approved examples, questions, rejections, and guidance).

NOTE: Object of front-end analysis is to "get smart" on the system so that COIC can be properly focused and accurately reflect bottom line critical mission accomplishment and sustainment performance standards.

b. Draft COIC for MS I TEMP. In conjunction with submission of the draft ORD to HQ TRADOC for approval, the CBTDEV proponent prepares draft COIC focused on the full production (MS III) decision. The critical issues, being based on the MNS, are unlikely to change as the system proceeds through the acquisition phases. Criteria, on the other hand, may initially be "soft" (i.e., lack specificity). Detailed preparation considerations and guidelines are found in Chapter 3 of this Part.

********INSERT FIGURE 2-2***********

2-6. COIC coordination and approval for MS I TEMP (Figure 2-3)

a. CBTDEV proponent coordination. Following receipt of the TRADOC approved ORD (forwarded to HQDA NLT 185 days prior to MS I), the CBTDEV proponent makes appropriate adjustments to the draft COIC and coordinates them with the MATDEV, operational evaluator, and TRADOC Analysis Command (TRAC). Coordination with the MATDEV will ensure synchronization with software requirements definition documentation, RAM (reliability, availability, and maintainability) rationale reporting, and system specifications to be documented in a request for proposal (RFP). Coordination with the operational evaluator will ensure that COIC are testable, measurable, or otherwise evaluatable and provide an appropriate structure for the operational evaluation. Additionally (Block 3A), in that COIC focus on the full production (MS III) decision, the MATDEV with CBTDEV and IOE assistance system formulates performance exit criteria for the MS II (Development) decision review. Coordination with TRAC ensures appropriate COEA synchronization.

NOTE: A discussion of the relationship of performance exit criteria to COIC can be found in Section IV, this chapter.

b. CBTDEV proponent submits COIC for approval. Not later than 140 days prior to MS I, the CBTDEV proponent forwards the coordinated, final draft COIC to HQ TRADOC for review and approval. Concurrently, the MATDEV includes the draft COIC in the draft TEMP to maintain currency of the TEMP.

c. HQ TRADOC quality check. At HQ TRADOC, the TRASSO performs a final quality check and, if necessary (Block 5A),

revises the COIC with assistance of the CBTDEV proponent. When required, MATDEV and/or operational evaluator may assist.

d. MS I TEMP COIC approval staffing. Following DA approval of the ORD and not later than 125 days prior to MS I, with a 2-week suspense, the TRASSO formally staffs the final draft COIC with the TRADOC Materiel Evaluation Committee (TMEC), HQ OPTEC, and the MATDEV. Additionally, the TRASSO effects action officer (A/O) level coordination with DA DCSOPS (DAMO-FDR). If DA changed ORD during approval, TRASSO takes lead to effect changes to COIC, as necessary, with assistance as required (Block 5A).

e. COIC approval for MS I TEMP. The TRADOC DCSCD approves COIC NLT MS I minus 95 days and provides them to the MATDEV for inclusion in the TEMP as paragraph 4B, Part IV. If he directs changes, the process loops back to Block 5, TRASSO quality check.

NOTE: The obvious pitfall here is one of timing, considering that restaffing could take as much as two additional weeks and thereby potentially negatively impact MS I.

***********INSERT FIGURE 2-3*************

2-7. MS I TEMP approval and operational requirement maturation (Figure 2-4)

a. TEMP approval processing. The MATDEV submits ACAT I, II, and OSD T&E Oversight system TEMP for review and approval to TEMA/DUSA(OR), 65 days in advance of MS I, as an integral part of the TEMP. TEMA forwards the approved TEMP to OSD for review and approval 45 days in advance of MS I. If changes are directed at either DA or OSD level (Block 9A), an ad hoc working group (DCSOPS (DAMO-FDR) A/O, TRASSO, CBTDEV proponent, MATDEV, and operational evaluator) resolves the changes and their impacts (Block 9B). The TRADOC DCSCD reviews and approves revised COIC (Block 9C) for incorporation into and resubmission of the revised TEMP by the MATDEV (Block 9D to Block 9). <u>An approved TEMP is required at MS I.</u>

b. OPTEC Early Operational Assessment (EOA) planning. Following receipt of the approved TEMP, OPTEC incorporates COIC into the TEP for Early Operational Assessment (EOA) and uses them, along with any Decision authority approved performance exit criteria, as a basis for finalization of Additional Operational Issues and Criteria (AOIC) to guide the test and evaluation effort. Chapter 3, this Part discusses AOIC.

c. CBTDEV identifies required COIC revisions. The operational requirement matures as a system progresses through

its acquisition phases. As a result, revisions to COIC may be necessitated to ensure that they continue to adequately and accurately represent features/capabilities critical to mission performance and provide a proper focus for the decision process. Additionally, the CBTDEV proponent needs, when and where possible, to restructure criteria to reflect a greater level of specificity (firmness) than that found in the "soft" criteria of the initial set. The CBTDEV proponent identifies necessity for change/update by actively participating in and maintaining full cognizance of the system's developmental progress. First among many potential sources of change is the Acquisition Decision Memorandum (ADM), which documents decisions and directives of the Milestone Decision Review (MDR) and approves the system concept baseline (MS I) and exit criteria for the next MS. Additional sources include, but are not limited to, results from EUTE/EOA (Block 11), emerging results from the COEA, the ORD refinement/revision process (to culminate in HQ TRADOC approval 230 days in advance of MS II), and development of the RAM Rationale Report and materiel specifications for the RFP.

***********INSERT FIGURE 2-4***********

2-8. COIC update by the CBYDEV for MS II TEMP (FIGURE 2-5)

a. CBTDEV proponent updates COIC. The CBTDEV proponent updates COIC as necessary, to include the addition of "firm" MS III criteria (i.e. provides a specific, usually quantitative, performance threshold). Concurrently (Block 13A), he works with the operational evaluator and PM in the formulation of LRIP and/or MS III exit criteria.

NOTE: Exit criteria for MS II were formulated pre-MS I, approved during MDR-I, and documented in the ADM.

b. CBTDEV proponent COIC coordination. The CBTDEV proponent coordinates draft COIC with the PM, operational evaluator, and TRAC, and, not later than 185 days in advance of MS II, submits the final draft COIC to HQ TRADOC for review and approval. Concurrently, the MATDEV includes the final draft COIC in the TEMP for TIWG staffing.

c. HQ TRADOC quality check of COIC. At HQ TRADOC, the TRASSO performs a final quality check and, if changes are necessary (Block 16A), revises the COIC with the assistance of the CBTDEV proponent. Additional assistance, when required, is drawn from the PM and/or operational evaluator.

d. CBTDEV COIC approval staffing for MS II TEMP. Not later than 170 days in advance of MS II, HQ TRADOC (TRASSO) formally staffs the final draft COIC with the TMEC, HQ OPTEC, and the PM.

Additionally, the TRASSO effects A/O level coordination with the DA DCSOPS (DAMO-FDR). DA must approve the revised ORD before this coordination may proceed. Since submission and quality check may occur before ORD approval, changes may be needed to be consistent with the ORD. If this is the case, the TRASSO effects necessary changes, with assistance as required (Block 16A).

NOTE: For ACAT ID programs, for which the Under Secretary of Defense (Acquisition) is the milestone decision authority, not later than dates are 15 days earlier than reflected in the text or on flow chart elements to accommodate Army review and approval in advance of the Defense Acquisition Board (DAB) review.

e. CBTDEV (HQ TRADOC) submits COIC for MS II TEMP to HQDA. The DCSCD, HQ TRADOC approves the COIC for TRADOC, not later than 140 days in advance of MS II, and submits them (Block 18A) through the Commanding General (CG) OPTEC for endorsement to HQDA (DAMO-FDR) for ADCSOPS-FD approval. Advance copies are provided to HQDA (DAMO-FDR), the PM, Operational Evaluation Command (OEC), appropriate TRADOC centers and schools, and others.

************INSERT FIGURE 2-5****************

2-9. COIC approval processing for MS II TEMP (Figure 2-6)

a. CG OPTEC endorsement of MS II TEMP COIC. CG OPTEC concurs in the COIC and endorses them to HQDA (DAMO-FDR), NLT 115 days in advance of MS II, as testable, measurable, or otherwise evaluatable and capable of providing an appropriate structure for the operational evaluation in support of the full production (MS III) decision. In the event of CG OPTEC nonconcurrence, DCSCD TRADOC (Block 19A) directs revision (return to Block 16A) or opts to allow the nonoccurrence to remain an issue for resolution at the DA ADCSOPS-FD decision briefing.

b. MS II TEMP COIC approval brief preparations. DAMO-FDR schedules the DA ADCSOPS-FD Director pre-brief and the ADCSOPS-FD decision briefing. The CBTDEV proponent prepares the COIC-ORD cross-walk "Horse Blanket" and provides it to HQ TRADOC, if required, for review or possible pre-brief. DAMO-FDR also prepares a decision package for the ADCSOPS-FD, taking into account COIC experience, CG OPTEC concurrence/nonconcurrence in the TRADOC approved COIC, and the COIC-ORD crosswalk package.

NOTE: The basic content of the "Horse Blanket" and its physical layout are depicted within a dashed-line box on the flow chart. A detailed description of the "Horse Blanket", its content, and sample questions occurring during briefing are presented in Section V of this chapter.

c. COIC approval pre-brief. A COIC-ORD Crosswalk pre-brief (normally 1-2 days before the formal briefing and chaired by the ADCSOPS-FD Integration Director) determines readiness of the briefing for ADCSOPS-FD. Changes directed at this stage will normally be made without delaying the approval briefing.

d. MS II TEMP COIC brief. The ADCSOPS-FD reviews and approves COIC via the COIC-ORD Crosswalk briefing conducted not later than 100 days in advance of MS II. Coordinated by DAMO-FDR, briefing participants include the DA DCSOPS System Integrator (SI), the TRASSO, and representatives of the CBTDEV proponent, PM, IOE, TRADOC System Manager (TSM), DCSINT, and others as needed. The TSM or Proponent CBTDEV /FP briefs. When required, this briefing also serves as a joint DA ADCSOPS-FD, CG OPTEC, TRADOC DCSCD joint meeting to address unresolved conflicts, e.g., CG OPTEC nonconcurrence in the TRADOC approved COIC. If minor changes to the COIC are directed, they are handled by the DAMO-FDR A/O (Block 25A). If the changes are significant, however, a return to Block 16A is probable.

e. COIC approval for MS II TEMP. ADCSOPS-FD approves the COIC and forwards them to the TIWG Chair (MATDEV or PM) for inclusion in the TEMP not later than 95 days in advance of MS II.

**************INSERT FIGURE 2-6***************

2-10. MS II TEMP approval and COIC updates (Figure 2-7)

a. TEMP approval processing. The PM submits system TEMP for review and approval to TEMA/DUSA(OR), not later than 65 days in advance of MS II. TEMA forwards the approved TEMP to OSD for review and approval not later than 45 days in advance of MS II. If changes are directed at either DA or OSD level (Block 27A), DA DCSOPS (DAMO-FDR) A/O, TRASSO, CBTDEV proponent, MATDEV/SFTDEV, and operational evaluator resolve the changes and their impacts (Block 27B). The DCSCD TRADOC and ADCSOPS-FD HQDA reviews and approves revised COIC (Block 27C) for MATDEV inclusion into and resubmission of the revised TEMP (Block 27D to Block 27).

b. OPTEC IOT&E preparations. Following receipt of the approved TEMP, OPTEC incorporates COIC into the TEP for IOTE and uses them, and performance exit criteria, as a basis for development of Additional Operational Issues and Criteria (AOIC) (see chapter 3, this part) necessary to the evaluation effort.

c. Post MS II COIC changes. Post MDR-II (Development Approval), the CBTDEV proponent continues to actively participate in and maintain full cognizance of the system's developmental progress. In that firm MS III COIC were approved and included in the TEMP at MS II, COIC will not be further modified unless

directly affected by operational requirements changes (e.g., necessitated by new/revised threat intelligence information) or program restructure (e.g., performance to be achieved by MS III or as a result of Block Improvements). If revision is necessitated, the CBTDEV proponent reenters the process and completes Blocks 13-28, to support of the full production decision (MS III). Further, in the event an ACAT III system becomes designated a OSD T&E Oversight system after MS II, the CBTDEV proponent reenters the process and completes Blocks 15-28.

d. COIC for system modifications. Only developmental modifications require COIC (i.e., preplanned upgrades and other modifications responding to ORD revisions). For such modifications, a TEMP with approved COIC is a key element of the modification proposal approval package. These elements will guide the evaluation and decision to adopt the modification. The CBTDEV proponent therefore reenters the process and completes Blocks 13-27 in support of the modification approval (MS IV). DOD 5000.2 requires MS IV to approve initiation of major modifications. Paragraph 2-1, this chapter provides additional information on modifications requiring COIC.

NOTE: When changes are required after MS II, process timing is keyed to days in advance of DA approval of the TEMP as per Table 2-3, this chapter.

************INSERT FIGURE 2-7************

2-11. Sample final COIC coordination and approval submission memorandums for those requiring HQDA, ADCSOPS-FD approval

a. Final COIC coordination memorandum. Figure 2-8 provides a sample final coordination memorandum for COIC requiring HQDA, ADCSOPS-FD_approval. The following observations are made regarding this memorandum:

(1) This coordination is the basis for TRADOC, DCSCD approval and submission of the COIC to DA. Only CG OPTEC or ADCSOPS-FD can cause TRADOC to revisit the COIC once approved by the TRADOC, DCSCD. The TRADOC Materiel Evaluation Committee (TMEC) advises whether the COIC appropriately reflect the operational requirements. The PM advises whether the COIC are compatible with technology and contractual documents. OPTEC advises whether the COIC are testable, measurable or otherwise evaluatable. DAMO-FDR provides DA action officer coordination and advise confirming latest events in HQDA relative to the system and COIC.

(2) This is the last coordination with the PM before the COIC approval brief to ADCSOPS-FD. CG OPTEC has the opportunity

to confirm concurrence in the COIC by endorsing the TRADOC, DCSCD approved COIC to HQDA for approval. The DA staff have the opportunity to concur with the COIC during decision package coordination.

(3) A two week suspense for this action is normal. Occasionally shorter or longer time frames may be available. Two weeks is about the maximum allowance to support approval within 30 days after receipt at HQ TRADOC as allowed by the ORD, COIC, and TEMP synchronization schedule.

(4) Significant changes will be recoordinated using expedited procedures (most likely electronic mails or fax) with short turnaround required.

(5) Any significant delay during the coordination will likely jeapordize the TEMP submission schedule. This applies to the initial as well as follow-up coordination.

(6) The TRADOC proponents are kept informed regarding the status of their COIC by the copy furnished distribution.

****************INSERT FIGURE 2-8************

b. COIC submission for HQDA, ADCSOPS-FD approval memorandum. Figure 2-9 provides a sample COIC approval submisission memorandum. The following observations apply to this memorandum:

(1) The submission is through CG OPTEC to HQDA (DAMO-FDR) in keeping with the guidance that only CG OPTEC and the ADCSOPS-FD can cause TRADOC to revisit COIC approved by DCSCD, TRADOC. CG OPTEC endorsement attests to the COIC being testable, measurable, or otherwise evaluatable and provide structure for operational evaluation. A nonconcurrence or significant comment should be exceptional circumstance since OEC has been evolved throughout the COIC development process and OPTEC provided its position during TRADOC final position staffing.

(2) The memorandum recognizes whether TRADOC, PM, and OPTEC agreement was reached during the TRADOC approval process. In those cases where agreement not reached, the difference of position is described.

(3) The copy furnished distribution keeps key players in the COIC approval briefing informed as to status of the COIC. In the case of DAMO-FDR and the TRADOC proponent this distribution provides an advance copy of the COIC to support preparation for COIC approval brief.

**********INSERT FIGURE 2-9************

Section III
Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on OSD T&E Oversight List (Figure 2-10 through 2-14).

2-12. Forward

Procedures for development, review, and approval of COIC for ACAT III/IV materiel and T/T non-MAISRC IMA systems not on the OSD T&E Oversight List are similar to those for ACAT I/II materiel, T/T MAISRC IMA systems, and OSD T&E Oversight systems. Primary differences are approval authority and timing (Figure 2-2, this chapter). As in previous section, descriptive paragraphs appear on one page and corresponding flow chart elements on facing page. Process also apply to COIC for developmental modifications to these systems. <u>Reflected Not Later Than (NLT) dates are minimum deadlines for on schedule delivery of the TEMP. Managers should therefore establish appropriate internal suspenses to effect early COIC approval and TEMP submission.</u> Dotted/dashed boxes and lines are information events. A checklist to assist in the process is at Section V, this chapter. When appropriate, "NOTES" are added to highlight actions called for in the paragraph or to provide some other insight into the action required.

2-13. CBTDEV proponent Drafts COIC for MS I TEMP (Figure 2-10)

a. CBTDEV front end analysis. The process begins with the CBTDEV proponent conducting COIC front-end analysis. This analysis uses as its base the MNS approved at Milestone 0 and draws from ORD formulation process. Additional considerations include when available: baseline intelligence products (or the System Threat Assessment Report (STAR)); system critical mission(s) and function(s); system employment and sustainment concepts; similar system(s) acquisition experience; studies/analyses used to justify the system requirement; the COEA; and recent COIC approval process experiences (approved examples, questions, rejections, and guidance).

NOTE: Object of front-end analysis is to "get system and COIC smart" to provide properly focused COIC with appropriate bottom line critical mission accomplishment and sustainment standards.

b. Draft COIC for MS I TEMP. With submission of draft ORD to HQ TRADOC for approval, and in coordination with MATDEV and IOE, the CBTDEV proponent prepares draft COIC focused on the full production (MS III) decision. The critical issues, being based on the MNS, are unlikely to change as the system proceeds through the acquisition phases. Criteria, on the other hand, may initially be "soft" (i.e., lack specificity). Detailed preparation guidelines are found in Chapter 3, this Part.

***************INSERT FIGURE 2-10**************

2-14. COIC coordination and approval for MS I TEMP (Figure 2-11)

a. CBTDEV proponent COIC coordination. Following TRADOC approval of the ORD NLT 120 days prior to MS I, the CBTDEV proponent makes appropriate adjustments to the draft COIC and coordinates them with the MATDEV, OPTEC, Combined Arms Support Command (CASCOM), TRAC, and HQ TRADOC. Coordination with the MATDEV will ensure synchronization with software requirements definition documentation, RAM (reliability, availability, and maintainability) rationale reporting, and system specifications to be documented in a request for proposal (RFP). Coordination with the operational evaluator will ensure that COIC are testable, measurable, or otherwise evaluatable and provide an ppropriate structure for the operational evaluation. Additionally (Block 3A), in that COIC focus on the full production (MS III) decision, the CBTDEV proponent interfaces with the MATDEV and operational evaluator to formulate system performance exit criteria for the MS II (Development) decision review. Coordination with TRAC will ensure appropriate synchronization with the COEA.

NOTE: A discussion of the relationship of exit criteria to COIC can be found in Chapter 3, this Part.

b. CBTDEV proponent submits COIC for approval. The CBTDEV proponent forwards the coordinated, final draft COIC to the TRADOC center/school (Proponent) commander, commandant, or assistant commandant (as appropriate) for review and approval.

c. COIC approval for MS I TEMP. The CBTDEV proponent (CDR/CMDT/AC) approves COIC at least 75 days prior to MS I and distributes them. TRADOC Regulation 71-3 provides distribution guidance for TRADOC. Minimum distribution includes HQ TRADOC (Block 5A), the operational evaluator (OPTEC - Block 5B) for incorporation in the TEP, and MATDEV (Block 5C) for incorporation into Part IV, Paragraph 4B of the TEMP

***************INSERT FIGURE 2-11**************

2-15. MS I and Post-MS I COIC activities (Figure 2-12)

a. HQ TRADOC COIC review. HQ TRADOC applies "management by exception" to ACAT III and IV as well as T/T IMA system COIC. If changes are directed (Block 6A), the CBTDEV proponent resolves the changes and their impacts (Block 6B), re-coordinates them

(Block 3), and resubmits them for approval (Blocks 4 and 5). An approved TEMP is also required for MS I for these systems.

b. OPTEC evaluation planning for MS II. OPTEC incorporates the approved COIC into the TEP for Early Operational Assessment (EOA), or Abbreviated Operational Assessment (AOA), and uses them as a basis for finalizing AOIC (Chapter 3, this part) to guide the MS II evaluation.

c. CBTDEV identifies required COIC changes. The operational requirement matures as a system progresses through its acquisition phases. As a result, revisions to COIC may be necessitated to ensure that they continue to adequately and accurately represent features/capabilities critical to mission performance and provide proper focus for the full production decision. After approval of the updated ORD and COEA for MS II, the CBTDEV proponent normally needs to restructure criteria to reflect a greater level of specificity (firmness) than that found in the "soft" criteria of the initial set (i.e., the criteria must provide an operationally meaningful and critical measure of mission performance for which a shortfall would be an operational "show stopper"). The CBTDEV proponent identifies necessity for change/update by actively participating in and maintaining full cognizance of the system's developmental progress. First among many potential sources of change is the Acquisition Decision Memorandum (ADM) or "minutes" of the In Process Review (IPR), which documents decisions and directives and approves the system concept baseline (MS I) and exit criteria for the next MS. Additional sources include, but are not limited to, results from EUTE/EOA/AOA (Block 8), emerging results from the COEA, the ORD refinement/revision process (to culminate in HQ TRADOC approval 120 days in advance of MS II), and development of the RAM Rationale Report and materiel specifications for the RFP.

**********INSERT FIGURE 2-12**************

2-16. COIC update and approval for MS II TEMP (Figure 2-13)

a. CBTDEV updates COIC for MS II TEMP. The CBTDEV proponent, in conjunction with the MATDEV, SFTDEV (theater/tactical IMA systems), and operational evaluator (OEC), updates COIC as necessary, to include the addition of "firm" MS III criteria. Concurrently (Block 10A), he works with the operational evaluator and MATDEV in the formulation of LRIP and/or MS III performance oriented exit criteria.

NOTE: When needed performance oriented exit criteria for MS II were formulated pre-MS I, approved during MDR-I, and documented in the ADM. In the event of a consolidated MS I/II, only one set

of approved documents (including COIC and TEMP) will be produced, even though the drafting process may go through several iterations.

b. MS II TEMP COIC coordination. The CBTDEV proponent coordinates final draft COIC with the MATDEV, OPTEC, CASCOM, TRAC, and the TRASSO not later than 115 days in advance of MS II, submits them to the Proponent for review and approval. Concurrently, the MATDEV includes the final draft COIC in the TEMP for TIWG staffing.

c. COIC approval for MS II TEMP. The CBTDEV proponent (CDR/CMDT/AC) approves for TRADOC the COIC for ACAT III and IV materiel systems as well as theater/tactical IMA systems not on OSD T&E oversight. Approval and distribution must occur at least 75 days in advance of MS II for on schedule approval of the TEMP without delay of MS II. CBTDEV distributes approved COIC to appropriate acquisition team members. TRADOC Regulation 71-3 provides distribution guidance for TRADOC. The following are mandatory recipients of COIC: HQ TRADOC (Block 13A) for information and action deemed appropriate, the operational evaluator (OPTEC - Block 13 B) for incorporation into the TEP, and the MATDEV (Block 13C) for incorporation into Part IV, paragraph 4B of the TEMP.

******************INSERT FIGURE 2-13***************

2-17. MS II and Post-MS II COIC operations (Figure 2-14)

a. HQ TRADOC review. HQ TRADOC applies "management by exception" to ACAT III and IV, as well as, theater/tactical system COIC. If changes are directed (Block 14A), the CBTDEV resolves the changes and their impacts (Block 14B), re-coordinates them as in Block 11, and resubmits them for approval as in Blocks 12 and 13 (Block 14c).

b. OPTEC evaluation plannaing for MS III. OPTEC incorporates approved COIC into the TEP for Initial Operational Test and Evaluation (IOTE) and uses them as a basis for finalizing AOIC (Chapter 3, this part) to guide the MS II evaluation.

c. CBTDEV identifies required COIC updates.

(1) The CBTDEV proponent continues to actively participate in and maintain full cognizance of the system's developmental progress. In that firm MS III COIC were approved and included in the TEMP at MS II, COIC will not be further modified unless directly affected by developmental modifications (i.e., preplanned block upgrades and other modifications to the system

responding to a revised ORD/MNS. If revision is necessitated, the CBTDEV proponent reenters the process and completes Blocks 11-13, in support of the full production decision. For modifications, the full production decision may be a MS III, a decision to adopt and apply an engineering change proposal (ECP), or the decision to procure Modification Work Order (MWO) sets.

(2) For system developmental modifications after initiation of production/fielding, a TEMP is included in the modification proposal approval package which, when approved, will guide the evaluation and decision to adopt the modification. COIC will be an integral element of the TEMP. The CBTDEV therefore reenters the process and completes Blocks 9-13 in support of the modification approval. Paragraph 2-1, this chapter identifies modifications which require COIC.

************INSERT FIGURE 2-14***********

Section IV
COIC Process for Strategic and Sustaining Base (S/SB) Information Mission Area (IMA) Systems

2-18. General
The development, review, and approval process for COIC applicable to strategic and sustaining base (S/SB) information mission area (IMA) systems is essentially the same as that for other systems. Differences are predominantly those of the organizations/activities involved and timing in relation to the milestone decision review (MDR). The process is graphically depicted in Figure 2-15.

***************INSERT FIGURE 2-15*******************

2-19. Strategic and Sustaining Base (S/SB) system COIC development, coordination, and approval (Figure 2-15)

a. Functional Proponent (FP) develops COIC. The process begins, at least 140 days prior to MDR I days, with the Functional Proponent (FP) developing COIC based on the MNS and Functional Description (FD), and staffing them internally.

b. FP forwards COIC to HQDA (ODISC4). The COIC are submitted to ODISC4, Analysis and Evaluation Office (HQDA, SAIS-AE) , at least 100 days prior to MDR I, for review and staffing. This phase also includes a COIC-MNS relationship briefing to the Chief, Analysis and Evaluation Office. Section V of this chapter provides format guidance for the briefing package.

c. COIC approval briefing to VDISC4. A decision briefing for COIC approval by the VDISC4 is presented at least 93 days prior to MDR I.

d. COIC approval and distribution. DISC4 approves and SAIS-AE forwards approved COIC to PM/TIWG chairperson for inclusion in the TEMP at least 79 days prior to MS I.

e. OPTEC review of TEMP. Following OPTEC review of the TEMP, the PM forwards it to TEMA for approval at least 65 days prior to MDR I .

f. TEMP approval. The TEMP is approved by the DUSA(OR) at least 45 days prior to MDR I.

g. S/SB IMA system COIC update or revision. As for other systems, COIC for S/SB IMA systems are subject to revision based on changes in the requirement and program redirection by the MDR decision authority. When change is necessitated, the process flow and timing for subsequent MDRs or other events (e.g., modification) parallel that described for MDR I.

Section V
COIC-ORD Crosswalk Brief Horse Blanket

2-20. General
The COIC-ORD Crosswalk "Horse Blanket" serves to graphically depict pertinent system information and the direct link between the ORD requirement and COIC criterion in support of the DA (ADCSOPS-FD) decision (approval) briefing for ACAT I, II, OSD T&E Oversight, and DA selected ACAT III and IV system COIC. The Horse Blanket (one or more pages measuring approximately 30 X 38 inches each) is prepared by the CBTDEV in the format depicted in Figures 2-16 and 2-17.

***************INSERT FIGURE 2-16****************

2-21. Horse Blanket first sheet contents
Page one (Figure 16) will contain, as a minimum, the following information:

a. A concise system description. Annotated line drawings or schematics may be used as appropriate to facilitate this description.

b. The Operational Mode Summary/Mission Profile (OMS/MP).

c. Threat description. A brief, unclassified description of the key threat(s) to the system that will exist at the time of fielding.

d. Operational Scenario. A synopsis of the operational scenario, i.e., how the system will be employed on the battlefield.

e. Program status. Program status to include funding and schedule.

***************INSERT FIGURE 2-17****************

2-22. Horse Blanket sheets 2 through n
Pages 2 through n (Figure 2-17), unless fully incorporated on page one, will contain the COIC-ORD crosswalk. All COIC (issue, scope, criteria, rationale, and notes) will be presented in their entirety. Applicable ORD requirement and rationale paragraphs will be referenced, stated and linked by color coded lines to the appropriate criterion. COIC will maintain their integrity as submitted for approval. ORD requirements will be cut, duplicated, and located as appropriate and necessary to support presentation of the COIC (i.e., ORD requirements section will not maintain its integrity). The ORD requirements column normally does not have to include all ORD operational will not include all does not requirements.

2-23. COIC approval pre-brief
Under DA ADCSOPS-FD Operational Requirements Directorate (DAMO-FDR) lead, the COIC-ORD crosswalk pre-brief is two to three days in advance, normally at the ADCSOPS-FD Integration Directorate (General Officer) level, to determine readiness for delivery of the decision briefing to the ADCSOPS-FD. Attendees include representatives from the PM office, DAMO-FDR, OEC, HQ TRADOC, and the TRADOC proponent center/school and/or TSM office.

2-24. COIC approval brief

a. The ADCSOPS-FD decision briefing, for approval of the COIC, occurs not later than 100 days in advance of Milestone II. The principal briefer is a representative of the TRADOC proponent school Director of Combat Developments (DCD) or the TRADOC System Manager (TSM). Required attendees (in addition to the briefer and DAMO-FDT representative) include the DA DCSOPS System Integrator (SI), the HQ TRADOC System Staff Officer (TRASSO), the TRADOC proponent school DCD or the TSM, the Program Manager (PM), a representative from OPTEC OEC, and a representative from DA DCSINT. Others (subject to space available) may attend as needed to answer specific questions.

b. Any thing on the Horse Blanket is subject top challenge but particularly the OMS/MP, ORD requirements, ORD requirements rationale, and the COIC. Examples of questions/areas of concern surfaced during the decision briefing include:

(1) Would you withhold program go-ahead if this criterion is not achieved? NOTE: If the criterion was properly selected and structured as a "show stopper," the answer should be "yes." A "No" response will cause the ADCSOPS-FD to direct rework of the COIC.

(2) What is the critical mission to be performed? NOTE: This question is avoidable in that system COIC should include one or more mission performance Critical Operational Issues (COI).

(3) How will the system be supported? NOTE: Because there is no mandatory requirement for a sustainment issue, the subject of this question may not be addressed by the system COIC. Attendees should, however, be prepared to answer this type question as an element of the system operational scenario.

(4) What is the basis for this ORD requirement? NOTE: This question should be avoidable if the "Horse Blanket" is properly structured to include the requirement rationale from the ORD.

(5) When was the OMS/MP last updated and on what basis? NOTE: The OMS/MP, as an element of the RAM Rationale Report (RRR) supporting the ORD, should have been updated by the CBTDEV following Milestone I, approved by HQ TRADOC NLT 230 days prior to Milestone II, and approved by HQDA NLT 170 days prior to Milestone II.

(6) How will this criteria be evaluated/tested? NOTE: This question is partially answerable from the "Horse Blanket" if the COIC (including scope) are included in their entirety as required. The Operational Evaluator must be prepared to provide detailed answer.

(7) What does this term mean operationally? Attendees must be familiar with the definition and operational impact of all terms used in the COIC. If not, they can jeopardize the successful outcome of the briefing.

2-25. COIC "Horse Blanket" for Information Mission Area (IMA) systems
The IMA system COIC "Horse Blanket" is similar to that for materiel systems. The "Horse Blanket" is used to brief ADCSOPS-FD for theater/tactical IMA systems and DISC4 for strategic and sustaining base IMA systems. The following categories apply:

a. System Description.

b. Operational Mode Summary/Mission Profile.

c. Threat Statement.

d. System Deficiencies.

e. Functional Improvements.

f. Programatics.

(1) Acquisition Plan/Program Schedule.

(2) Funding.

g. MNS/FD - COIC Crosswalk.

(1) MNS/FD Requirement.

(2) COIC.

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Chapter 3
COIC Development Considerations and Guidelines

Section I
General

3-1. COIC purpose

a. Primary purpose. The primary purpose of COIC is to focus and support milestone decisions. They prescribe (and provide a consistent emphasis on) the user's minimum operational effectiveness and suitability expectations from the total operational system for a go-ahead decision at the full production (normally MS III) decision. COIC reduce the multitude of operational considerations to a few operationally significant and relevant, mission focused issues and criteria. The COIC are relevant to both the combat mission operations and the full production decision, integrating operational mandates with maturity considerations for the total operational system. COIC are initially developed for the TEMP approved prior to MS I and updated as necessary thereafter. For intermediate milestone decisions (e.g., MS II (Development Approval) and LRIP authorization), the COIC provide operational focus and essential objectives to assist in judging the operational azimuth and potential of the concept or prototype.

b. Secondary purposes. Secondary purposes of COIC include serving: to focus and prioritize the operational evaluation effort (e.g., the operational evaluator reports system status against COIC for a decision review); to identify operational priorities for the acquisition effort (e.g., the system must satisfy criteria or be otherwise operationally justified to proceed); and to foster a coordinated effort by the members of the acquisition team by identifying what is operationally important (e.g., provide operational emphasis and focus for CBTDEV proponent and OIE assistance in MATDEV formulation of milestone decision review performance exit criteria).

c. COIC relationship to operational test. COIC are not Operational Test (OT) issues and criteria. As stated above, the primary purpose of COIC is to support milestone decisions and , secondarily, the operational evaluation. Data to answer the COIC can come from any credible source (e.g., Initial Operational Test (IOT), other operational test (OT), developmental technical test, field data collection, studies/simulations, etc.). While Initial Operational Test (IOT) is mandatory by law for ACAT I programs, other programs may not require OT for the full production (MS III) decision. It is therefore necessary that the independent operational evaluator determine, and document in the TEMP, the appropriate data source for COI resolution. The CBTDEV proponent/FP view point during development and approval of COIC

must be, "This is what is needed to make the full production decision," regardless of how the issue will be answered. As long as the COIC are "musts" for the decision, and can be answered by the independent operational evaluator, they are good.

3-2. COIC concept

COIC are, by definition, those decision maker key operational concerns (issues) with bottom line standards of performance (criteria) which, if satisfied, signify that a system is operationally ready to proceed during the full production (MS III) acquisition decision review.

a. Critical operational Issues. Key operational concerns (critical operational issues) are those which must be answered for the full production (MS III) decision to proceed. They are operationally oriented and not technology, cost, or politics focused. A system is considered operationally ready (effective and suitable enough) to proceed to full production when the following operational concerns are answered affirmatively (critical operational issue categories):

(1) Can the system accomplish its critical mission(s)?

(2) Can the system maintain preparedness for and be sustained during combat?

b. Criteria. Bottom line standards of performance (the criteria) are show-stoppers if not satisfied for the full production (MS III) decision. If a shortfall exists for one or more of the COIC criteria, convincing evidence (i.e., revised effectiveness, sustainability, and cost analyses and resulting considerations and review of program alternatives) must be provided for the decision authority to allow the program to proceed. Like the issues, the criteria are operationally oriented and not technology, cost, or politically focused. This does not mean that the criteria are operational test oriented, just that the criteria provide operationally relevant measures. While most criteria will be answered using data from some form of operational test, some, such as NBC contamination hardening (when a specific program objective), must depend on technical test or simulation data.

c. Total operational system focus. The system of concern is the total operational system (See Figure 3-1) as a composite rather than any of its component parts. Simultaneously, the total system of interest may be a single system (e.g., truck with trailer) or an operational unit (e.g., a team or platoon). This has several benefits, not the least of which is fewer issues. Other key benefits are that they are more relevant to operations than if focused on system components, and the potential for duplicate coverage is reduced.

***********INSERT FIGURE 3-1****************

d. COIC structure. COIC format provides for each issue: a scope paragraph (conditions for evaluating the issue), its associated criteria, and a rationale section (justification for each criteria). Additionally, the structure provides a notes section including two standardized mandatory notes (the first addressing the total system focus and coverage of the criteria; the second addressing the pass/fail application of the COIC) and other system specific notes as needed. A third mandatory note (stating that COIC are based on initial requirements and will be updated prior to MS II) is included for COIC supporting the MS I TEMP. As the structure indicates, the criteria are the instruments for judging whether an issue is satisfied (achievement of all criteria results in a satisfied issue). This structure applies to COIC coordination, approval, and processing, TEMP content, and TEP content. COIC are coordinated, staffed, and approved as a stand alone document. Figure 3-2 provides more details on the COIC coordination and submission format.

e. Initial COIC development and update. COIC are initially developed, approved, and included in the TEMP approved prior to MS I. They are subsequently updated as needed as the program progresses (particularly in response to the ORD and TEMP updates prior to MS II). The issues, being based on the MNS, will seldom change; however, the criteria will change as the operational requirement matures and in response to significant program restructures (e.g., shifting of "block" improvements). Criteria for the COIC applicable to the MS I TEMP (even if updated as a result of or in conjunction with a restructure of the Demonstration and Validation Phase effort) may be soft (provide a performance standard but not a final performance threshold). Criteria for the COIC applicable to the MS II TEMP will be firm, measurable performance thresholds.

***************INSERT FIGURE 3-2****************

3-3. Front end analysis

a. Key system knowledge to attain. As with many processes, that for COIC first requires that the writers do the necessary research - lay the groundwork - which will serve as a foundation for his efforts. In short, he must "get smart" on his system and lessons learned on similar systems to do a credible job. Key considerations include, but are not necessarily limited to:

(1) The reason(s) for a new system or modification to an existing system - the need.

(2) The system's critical mission(s) and function(s).

(3) The system's employment and sustainment concepts.

(4) The system's acquisition status.

(5) Acquisition experiences for similar systems, e.g., reasons for T&E or proceed decision problems, etc.

(6) Recent COIC approval process experiences, e.g., examples of and/or lessons learned from those which engendered questions, guidance, rejection, or approval by decision makers.

b. Key information sources. Key documents which serve as sources for "get smart" information are itemized below. Each is important in its own right, but of greater importance is their contribution to the synergism of system documentation. It therefore behooves the COIC writer to become intimately familiar with their purpose and content before he proceeds. This list is not meant to be exhaustive; therefore, the COIC writer must during this phase be careful to identify those other system peculiar documents with information in the above areas. It should be noted that system requirements documented before February 1991 (publication of DoDD 5000.1, DoDI 5000.2, and DoD 5000.2-M) made use of the Operational and Organizational (O&O) Plan and Required Operational Capability (ROC), while those after Feb 91 made use of the MNS and ORD.

(1) Mission Need Statement (MNS).

(2) Operational Requirements Document (ORD).

(3) Software Functional Description (FD).

(4) System Threat Assessment Report (STAR).

(5) Cost and Operational Effectiveness Analysis (COEA).

(6) Reliability, Availability, and Maintainability (RAM) Rationale Report (RRR).

(7) Milestone Decision Review (MDR) Minutes.

(8) System Specifications (Request for Proposal - RFP).

3-4. Relationships

In the broadest sense, COIC are derived from the documented operational requirement to reflect those minimum essential operational concerns and operational performance standards key for achievement of full production authorization at the MS III decision and to serve as the priority focus for the supporting operational evaluation. In detail, these inherent relationships

to the requirement, the decision process, and the supporting evaluation are more complex.

***************INSERT FIGURE 3-3********************

a. COIC and the operational requirement. The operational requirement, along with key employment considerations, are essential to establishing operationally valid, relevant, and credible COIC. As depicted in Figure 3-3, the operational requirement presents itself in many forms dependent on the system. If the COIC developer and the Acquisition Team do their jobs correctly, there will be compatibility between COIC and the key documents listed.

(1) COIC and the operational requirements documents (MNS/ORD). For materiel system acquisitions, the critical operational issues will be based on the MNS and thus unlikely to change as the program proceeds. The criteria will be based on the ORD and thus change as the requirement matures. Automated information systems which are not part of a materiel acquisition do not have a document comparable to the ORD; therefore, both their issues and criteria are based on the MNS. The COIC writer for AIS uses the Functional Description (FD) to support the MNS. (A note of caution applies here regarding the potential for technical measures and lack of operational relevance for some ROC/ORD/FD requirements. The COIC writer is often better served by the rationale for the requirement than by using the actual requirements.) "Being based on" does not mean that issues and criteria are direct lifts from these documents, but that there is a clear, auditable foundation for the issues and criteria in these documents. For example, the ORD may require a significant survivability improvement over the existing system, whereas the COEA and cost considerations may result in a criteria to complete 20 percent more missions with 50 percent more threat neutralized. The COIC rationale provide a crosswalk between the ORD minimum acceptable requirements and the COIC.

(2) COIC and the Cost and Operational Effectiveness Analysis (COEA). The COEA is the primary analytical document of operational consideration during MS I and MS II decisions. It compares the relative cost and operational effectiveness for alternative concepts considered and indicates their relative status to the baseline. As such, it has significant influence on the concept chosen to proceed. This influence has a significant bearing on the requirement document and COIC. The COEA provides relevant effectiveness and cost considerations such as significantly improved performance at significantly reduced cost. For instance, if the COEA shows a significant cost saving over the baseline and this is the purpose of the acquisition (modernization), then the criteria should reflect a system which is as mission capable, trainable, and sustainable in combat as

the existing system. The COEA uses various measures of performance (MOP) for which sensitivity runs could aid in establishing criteria for the COIC. Because of the significance of the COEA to the program, there must be an audit trail of consideration between the COIC and the COEA.

(3) COIC and the system specification. The primary concern here is compatibility between the COIC and the specification (or contract represented by the specification). If COIC are fully documented in the ORD, there is no reason for incompatibility between the specification and the ORD since the specification must be compatible with the ORD. The MATDEV assures this compatibility, or, when COIC are developed late, advises when an incompatibility exists. Occasionally the specification serves to document operational performance parameters which did not make it into the ROC/ORD (e.g., the ROC requires a level of connectivity for communications users - the specification requires a level of successful transmission given connectivity exists).

(4) COIC and other requirements documents (Studies and Cost). When neither the MNS/ROC/ORD/FD, COEA, nor specification provide all requirement information needed to develop valid COIC, then other sources are tapped. Most of the time these aspects are considered in establishing MNS/ROC/ORD/FD requirements (e.g., operation and support costs are used in establishing RAM requirements considered during COIC development).

b. COIC and operational employment considerations. To produce operationally realistic and valid COIC, the COIC writer must understand and continually focus on the operational mission(s) (described in the Operational Mode Summary/Mission Profile (OMS/MP) appendix to the ORD) and system employment tactics, techniques, and procedures. An understanding of how the system fights/operates is critical to determining if system or organizational type measures should apply (e.g., a system which fights as an element of a platoon of ten, with target detection and hand-off for engagement accomplished internal to the platoon, should not be measured as a single, stand alone system). Similarly, an understanding of how system operations will be logistically supported is essential in defining sustainment COIC. Operational requirements must therefore be examined in light of operational employment considerations to arrive at meaningful criteria for COIC.

c. COIC and performance exit criteria. COIC criteria, by definition, are bottom line standards which, if satisfied, indicate that a system is operationally ready to proceed to full production. Exit criteria, meanwhile, are established in accordance with DoDI 5000.2 at each milestone for the next milestone (e.g., at MS II for MS III) and for major events between milestones (e.g., long lead time procurement and LRIP

authorizations). They are minimum requirements that must be successfully demonstrated for the program to proceed. Performance exit criteria, as such, serve as decision point measures of progress ("stepping stones") toward achievement of COIC criteria and, eventually, mature system objective performance. While the CBTDEV proponent has the lead in developing the full production (MS III) COIC, the MATDEV has the lead in developing exit criteria and does so with the assistance of the CBTDEV proponent and in coordination with the independent operational evaluator. Most MS II performance exit criteria will measure feasibility of fulfilling operational needs. The full production performance exit criteria and COIC focus on a mission capable, affordable system. The relationship of COIC and performance exit criteria is depicted in Figure 3-4. This figure represents a criteria compendium as the system moves from MS II to MS III. Section IV, this chapter contains a detailed discussion of criteria for critical operational issues.

***********INSERT FIGURE 3-4**************

d. COIC and the operational evaluation. The Operational Independent Evaluator (OIE) is responsible for planning an operational evaluation that will answer the COIC for the full production (MS III) decision. Any source of data (e.g., operational test, developmental test, study, and/or survey) judged credible by the OIE can be used to answer the COIC. The evaluator reports the system achievement against the COIC at the full production decision. Plans and reports for follow-on operational evaluations will use these same COIC. The COIC are first documented in the TEMP prior to Milestone I to influence the program and operational evaluation planning and conduct leading to Milestone II. Additional responsibilities for the OIE include:

(1) Providing an evaluation of the operational status of the system and readiness to proceed at Milestone II and subsequent milestone decisions. When tasked by the decision authority, providing follow-on operational evaluations after Milestone III to address correction of shortcomings found at Milestone III.

(2) Providing a determination whether the minimum acceptable operational performance requirements stated in the ORD have been satisfied.

(3) Providing a complete and comprehensive evaluation of the system's operational effectiveness and suitability. This includes being able to isolate (or point in the direction of) the cause of operational shortfalls whenever possible.

(4) Identifying the data required from operational test, technical test, studies, and other sources to accomplish the evaluation (i.e., define the specific test, study, and other issues necessary for evaluation).

(5) Providing a baseline comparison assessment for the full production decision.

To accomplish these many responsibilities, the OIE prepares a more definitive set of operational issues and criteria known as Additional Operational Issues and Criteria (AOIC). The OIE documents the AOIC in Chapter 2 of the operational Test and Evaluation Plan (TEP).

***************INSERT FIGURE 3-5***************

e. COIC and AOIC.

(1) While the focus of COIC is on the minimum needed to know what is good enough operationally for a go-ahead decision at the full production decision point, AOIC focus on a complete and comprehensive evaluation of the system's operational effectiveness and suitability. COIC concern is an operationally effective and suitable total system, as evidenced by the total system's readiness for and capability to sustain accomplishment of critical missions during combat. AOIC concern is for the operational effectiveness and suitability of the total system as evidenced by performance of the components of operational effectiveness and suitability (see Figure 3-5).

(2) AOIC are developed by the OIE based on the COIC, MNS, ROC/ORD, system specification, COEA, applicable regulations and pamphlets, RAM Rationale Report, and other sources. AOIC are structured in the same basic four-part format as COIC (i.e., issue with associated scope, criteria, and rationale). Since AOIC support a complete and comprehensive evaluation, they tend to be more diagnostic and may include investigative issues (start with "How well" or "What is") which do not require criteria. <u>COIC never include investigative issues</u>. AOIC support COIC resolution as follows (see Figure 3-6):

*******************INSERT FIGURE 3-6*******************

(a) Allow the OIE to specify the data required from multiple sources (in the form of issues and criteria) for COIC not directly answerable from operational test. For tester, analyst, and evaluator execution purposes, these AOIC are just as critical as the COIC they support. If the data are not provided, the OIE will not be able to evaluate the issue for the full production decision - thus, no decision.

(b) Provide the OIE the diagnostics to identify factors contributing to or causing a performance shortfall for one or more of the COIC.

(c) Complement the COIC by providing a comprehensive evaluation of all aspects of the total operational system. In the event of a performance shortfall for one or more COIC, the AOIC may provide the evidence needed to convince decision makers that the system is good enough to proceed (e.g., baseline comparison or minimum acceptable operational requirements accomplishments). In the event the COIC are satisfied, the AOIC may identify areas for continued improvement as the system proceeds in acquisition.

Section II
Identifying the Issues

3-5. Characteristics
Critical operational issues, by definition, are those key operational concerns, expressed as questions, which, when answered completely and affirmatively, signify that a system or materiel change is operationally ready to transition to full production. They are few in number, based on the MNS, and focused on the full production (MS III) decision. There are four key components of a properly structured critical operational issue statement:

a. The interrogative. An interrogative word demanding a "yes" or "no" answer (e.g., Does, Can, or Is).

b. The system. Identification of the system of concern (e.g., system X or a platoon equipped with system X).

c. The capability. A capability of concern (e.g., robust voice and data communication or effective aerial reconnaissance).

d. The conditions. The set of applicable operational conditions (e.g., during combat operations or as employed by Special Operations Forces).

3-6. Focus

a. Total operational system concern. Critical Operational Issues (COI) focus on the total operational system as an entity and its ability to satisfy the operational deficiency or efficiency defined in the Mission Need Statement (MNS). This overarching focus for COIC results in a few issues which seldom change as the system progresses through the acquisition process. While the norm is three issues (e.g., one mission capability, one deployability/mobility/interoperability, and one sustainability), as few as one (single shot item or materiel change) or as many as

six (a family of trucks) may be appropriate. This focus breaks the mind set of separate operational effectiveness and suitability issues. A single issue will often cover the areas of mission performance, survivability, RAM, MANPRINT, and software performance (e.g., probability of successful communications for a communications net or probability of kill for a direct fire weapon).

b. COI relevancy. Operational relevancy translates as "accomplish critical mission(s)" and "prepared for and sustained in combat." "Accomplish critical mission(s)" means not only that the system is capable of performing its mission functions, but that it survives to the degree needed during the mission, can interoperate with Army, Allied, and other-Service systems necessary for mission success, and, for rapid deployment and remote units, is deployable to the site of combat operations. NOTE: For other than rapid deployment or remote units, deployability may be a sustainability issue. "Prepared for and sustained in combat" means that crews must maintain proficiency in garrison and planned logistics support must provide responsive maintenance, supply, and transportation for the system during combat.

c. COI development procedure. From the view of minimizing the COI, preparation of the COIC starts with the mission accomplishment issue. Normally a good procedure to stating the critical mission accomplishment issue is to frame critical mission/task order to be given by higher headquarters as the issue (e.g., Can the unit equipped with system x take and hold the tactical objective on the future battlefield? or Can truck x pick up and transport required tactical loads to objective location as required in support of combat operations?). Complete that issue with its scope, criteria, and rationale. Then, if there is anything remaining unaddressed in the mission accomplishment area, define that issue with its scope, criteria, and rationale, remaining cognizant of the first issue and criteria to avoid duplication or overlapping coverage. Once the mission area is complete, consider the need for a sustainment issue. If considered not needed, provide rationale in your cover memorandum when coordinating the COIC and when submitting the COIC for approval. Once the set of COIC is complete, review it for duplication or overlapping coverage, and eliminate any issue subsumed by another.

3-7. Developing the issue - Questions to Ask

a. What is the system of interest? For example: individual system (tank, rifle, etc), system of systems (communications network), or system component change (improved missile warhead).

b. Why the system (or materiel change)? For example: the deficiency the system is being designed to correct or opportunity it is intended to seize.

c. What is (are) the critical mission(s)? For example: consider all against the question, "Which mission requirement(s), if not satisfied, will engender a "No-Buy" decision?", and, where there are more than one, "Which mission is the more rigorous/demanding?".

d. Are there critical user unit concerns? For example, is the system deployable by light forces - if not, is a "No-Buy" decision in order?

e. What are concerns regarding sustainment? For example, is Ammunition Supply Point (ASP) throughput capacity sufficient to support a significantly higher rate of fire capability for a cannon artillery system?

3-8. Developing the issue - DOs and DON'Ts

NOTE: Each DO is followed, when appropriate, by one or more companion DON'Ts.

a. Focus. DO focus the issue so as to focus the evaluation and decision. State a question which asks if a task can be performed under the conditions of concern (e.g., Does the Nipper effectively close with, detect, engage, and destroy threat armor under expected battlefield conditions?).

DON'T over generalize (e.g., Is the Nipper operationally effective? or "Is the Nipper operationally suitable?).

DON'T include criteria in the issue statement (e.g., Does the Nipper find and kill "X" percent of threat armor within its area of operations?).

b. Decision issue. DO formulate the issue as a question which demands a "yes" or "no" answer (a decision). Begin the question with words such as "Can," "Does," or "Is" (e.g., Can Nipper equipped units achieve and maintain a level of training readiness during peacetime and provide for a wartime readiness capability for sustained combat operations?)

DON'T formulate the issue as an investigative in nature question, which demands an analytical answer, by beginning the question with words such as "How well" or "What is". For example, contrast, "How well does the Nipper close with, detect, engage, ..." with the example of 2.3.2.4a above. Note: an investigative issue may be appropriate for an AOIC, since they support the evaluation and not the decision.

c. Few issues. DO limit to a few by focusing on the total system need and concerns for the full production (MS III) decision.

DON'T duplicate coverage by overlapping issues (without good reason).

DON'T get bogged down in the "eaches" of a system (e.g., elements of operational effectiveness/suitability and ORD operational characteristics).

d. Apply experiences. DO use success as a guide (not as a rule). Apply experiences during recent COIC approval actions while recognizing system differences.

Section III
Defining the Scope

3-9. Characteristics

The scope, by definition, is a statement of the operational capabilities, definitions, and conditions which focus each issue and its evaluation. There will be a separate scope statement for each issue, even though the scope for the second or successive issues may refer to and expand on the scope statement of issue one. The scope normally begins with the words, "This issue examines...," and identifies:

a. Capabilities. Operational capabilities to be examined (e.g., mission accomplishment, sustainment training, and/or combat sustainment).

b. Definitions. Special terms, either system peculiar require definition (e.g., system description , communication connectivity, or vehicle payload) or measurement peculiar (e.g., start/stop points for time measures).

c. Conditions. Evaluation conditions, including: tactical context and scenario (e.g., operational mode summary/mission profile, Southwest Asia Standard Scenario); force structure and deployment considerations (e.g., Doctrine and Organization (D&O) Test Support Package (TSP) and Corps/Division/Other slice); Approved threat (e.g., Threat TSP and STAR); crew and maintainers descriptions; environmental conditions (natural and dirty battlefield).

d. Other data sources. When an issue and any of its criteria require technical test or modeling/analysis support.

3-10. Defining the Scope - Questions to Ask

a. What are the operational capabilities of concern?

b. Do force-on-force operations apply, and, if so, at what level (e.g., electronic warfare only or armored force in accordance with approved threat package and scenario)?

c. What friendly force structure and operations are necessitated (e.g., single system only or force slice; crew and maintainers; approved OMS/MP and scenario or only elements thereof)?

d. What environments apply (e.g., natural [terrain, visibility, day/night, climate] and battlefield [MOPP level, obscurants, ECM, etc.)?

e. What terms need definition (e.g., those which are system, operation, and measurement peculiar)?

f. Do any special evaluation methods apply (e.g., technical test or application of analytical means)?

3-11. Defining the Scope - DO's and DON'Ts

a. Focus issue. DO focus evaluation of the issue by identifying operational capabilities of concern, applicable operational conditions, applicable definitions, and special evaluation methodologies (e.g., when technical test or analytical means are used in lieu of or to supplement OT).

DON'T specify criteria (i.e., characteristics with performance standards).

DON'T specify rationale (i.e., justify the issue or criteria).

DON'T include specific conditions/definitions better suited as part of a criteria (e.g., detection/engagement envelope, line of sight, pallet weight for upload, etc.).

b. Development procedure. DO initially prepare the scope in draft and finalize only after developing applicable criteria (i.e., selection of specific criteria may in fact necessitate unique conditions, definitions, or evaluation methodologies not initially anticipated).

Section IV
Developing the Criteria

3-12. Characteristics
Criteria are, by definition, those measures of performance which, when achieved, signify that the issue has been satisfied. Criteria will be few in number, but there will be at least one criteria for each critical issue. Criteria will:

a. Be focused. COIC focus on the total operational system and the full production (MS III) decision, even though they may be soft for MS I (e.g., "Will be capable of killing tank X" versus "Will have a 50 percent chance of killing tank X"). When firm criteria are known early, they will be stated (e.g., "Will be capable of roll-on roll-off transportation by C-130 aircraft").

b. Reflect system maturity. COIC are formulated without losing sight of the fact that the "system" is in a constant state of development (e.g., even a nondevelopmental item frequently does not have mature tactics, techniques, procedures, and training at the full production (MS III) decision).

c. Be show stoppers. COIC are formulated to reflect show stopper measures (e.g., Believe if all criteria are met, the system is operationally good enough, or, to the contrary, if a criteria is not met, the full production decision will not be given). Mandatory Note #2 (see Section VI, this Part) is provided to avoid use of criteria as automatic pass/fail measures during evaluation and decision making such that other credible evidence of an operationally effective and suitable system will be considered when available to arrive at the proper decision.

d. Auditable to the requirement and COEA. This does not mean that criteria are a direct lift from these documents, but that they are traceable to specific requirements and findings of these documents by rationale.

NOTE: Criteria are categorized as "derived" when they are developed by combining two or more requirements into a single higher order of measure or drawn from sources (e.g., the COEA) other than the requirement to provide specific measures of performance not provided in the requirement document (e.g., the ORD requires improved survivability whereas cost and COEA data support a need for 20 percent more combat capable systems).

3-13. Criterion statement
Figure 3-7 depicts the major elements of a criterion statement, each of which must be addressed, and presents an example of a properly constructed criterion statement, with explanations for the specific wording. Special emphasis, when applicable, must be devoted to choosing which type of total system (individual or unit) is to be examined and whether the characteristic of interest is a performance standard or a baseline comparison. Additionally, the following must be considered: criteria mature with the operational requirement (soft for MSI and firm for MS II); system (hardware, software, tactics, techniques, and procedures, etc.) still maturing at MS III; information available from the requirement document (lack of specificity in performance parameters may increase the potential for evaluation bias and

thereby dictate use of baseline comparison); the acquisition objective (cost may override performance and the criteria therefore reflect current system performance). As reflected in the figure, there are choices for each element, wherein the correct choice is system/situation dependent (e.g., a tank and a communications system will have differently structured criteria). Figures 15 and 16 present additional system/situation examples of characteristics of interest and typical means of measurement (They are not complete criteria statements).

**************INSERT FIGURE 3-7******************

As an illustration of proper structure, consider the criterion statement, "The tank will kill 50% more enemy armored vehicles at ranges out to 3 kilometers."

The object to be examined is the tank.

The characteristic of interest is "kill armored vehicles," which constitutes a critical performance capability, and the qualifier "more" alludes to a comparison with a baseline.

The magnitude of 50% is quantitative and the direction "at least" is implied.

The constraint condition of "out to 3 kilometers" is both operational and tight, and "enemy" implies battlefield conditions.

The scoring criteria is kills, which would be based on definitions (e.g., mobility, firepower, catastrophic)

NOTE: A caution on constraint conditions - they must be operationally realistic. If, for example, their interpretation allows for use of unrepresentative threat or friendly operations in test and evaluation, they have been improperly stated.

**************INSERT FIGURE 3-8******************

**************INSERT FIGURE 3-9******************

a. Total system. As indicated earlier, special emphasis must be placed on choosing the correct total system - an individual system or an organizational unit - to be the object examined (see Figure 3-10). Factors which would lead to selection of a single system include: technical criteria (e.g., ascend/descend a 60 degree slope); the system operates and/or is employed as an independent system (tractor and trailer); or the purpose of the acquisition is to benefit the system alone (e.g., larger caliber tank main gun). Factors which would lead to selection of an organizational unit include: the purpose of the acquisition is to

benefit a unit (e.g., an automatic detection and defense system authorized one to a platoon to improve survivability); the system operates and/or is employed as an element of a unit (e.g., an air defense system - fire unit - which receives target cuing, hand-off, and engagement responsibilities/authority from the next higher element - platoon); the system represents a system of systems (e.g., a force level communications system made up of multiple, dissimilar subsystems - ATCCS); or a concern (characteristic of interest) which requires a unit measure (e.g., more combat capable vehicles remaining).

*************INSERT FIGURE 3-10****************

b. Performance standard versus baseline comparison criteria. Also as indicated above, special emphasis must be placed on determining whether the characteristic of interest can be stated as a performance standard or will require baseline comparison. Most characteristics of interest will be stated as performance standards. However, two key situations will dictate use of baseline comparison: the system is a replacement system or a materiel change to an existing system and requirements documents or other sources fail to provide an adequate basis for deriving performance standards; the independent operational evaluator identifies and justifies, to the satisfaction of the CBTDEV proponent/FP, sufficient risk of bias in T&E. Although this is a break with the past, when baseline comparison was reserved for exceptional cases and then only when absolutely necessary, baseline comparison is now encouraged in the situations outlined. It should be kept in mind, however, that the use of baseline comparison criteria results in side by side comparison testing to support evaluation of the system. The criticality of this approach to the evaluation effort must therefore be sufficiently high to justify the expenditure of significant additional resources.

3-14. Developing the criteria - DOs and DON'Ts

NOTE: Each DO is followed, when appropriate, by one or more companion DON'Ts.

a. Minimum need. DO focus on the minimum needed for full production (MS III) decision - discard or revise if a shortfall would not be a "show stopper."

DON'T include "desired" characteristics.

DON'T specify "firm" criteria for MS I TEMP unless known to be stable (e.g., transportable by CH-47D).

DON'T embed peripheral issues in criteria to ensure evaluation (e.g., the training program must be the optimum training strategy).

b. Measures of performance. DO use measures of performance which undergird the system's operational effectiveness and suitability in terms of critical combat missions to be accomplished.

DON'T use measures of effectiveness such as Force Exchange Ratio (FER), Loss Exchange Ratio (LER), or other COEA measures which depend on large scale modeling beyond the capability of the operational evaluation (operational test does not provide enough trials or steady state operations to revisit or substantiate the COEA).

c. Qualitative criteria. DO specify qualitative criteria (which must be measurable) only when quantitative criteria are not applicable.

DON'T specify a confidence level.

d. Test and evaluation limitation. DO specify measures without (unconstrained by) consideration of the applicable test/evaluation methodology to be used for resolution.

DON'T exclude a critical criteria because it can only be answered by technical test or modeling (criteria focus the operational evaluation and the decision, not a test).

DON'T compromise criteria to accommodate test and evaluation frailties (i.e., T&E instrumentation, facilities, or other resources should not restrict the criteria if it is deemed critical).

e. Probabilistic measures. DO specify soldier-machine measures in probabilistic terms, however they must be realistic (e.g., use the median if a high degree of performance is not needed, or 80/90% if a high degree is needed

DON'T specify or imply 100% performance when the operation must be accomplished by soldiers.

f. Conditions and definitions. DO specify the conditions and definitions needed for evaluation (e.g., the operational constraint (engagement envelope) and/or scoring criteria (stop/start point for a time line, destroy/kill definition, etc.)).

DON'T leave ambiguities which can result in erroneous T&E of the criteria (e.g., don't say "more survivable" because

survivability can be measured as either more combat vehicles remaining at a given point in time or as more threat kills because the vehicle remains combat capable longer).

DON'T over specify constraints and definitions (e.g., a constraint allowing operation only in temperatures above 70 degrees Fahrenheit would not support world wide deployment; the engagement constraint "targets entering the crew's fire zone" could be operationally limited by terrain rather than the range capability of a direct fire weapon).

g. Total system measures. DO specify total system measures (e.g., operator load vehicle, accomplish OMS/MP at stated speeds, C-130 roll-on/off, etc.)

DON'T specify component measures (e.g., materiel/software performance, human factors constraints, technical standards, etc.)

h. Lowest level system. DO specify the lowest level system possible and appropriate (the preference is a single system but, when required, an organizational level may be more appropriate) (e.g., the Paladin (M109A6) used the individual howitzer for mission accomplishment and the battalion for survivability; communications systems normally use nets for mission accomplishment and key components for set-up/tear-down time; trucks are typically addressed without trailers, etc.).

DON'T measure a structure which obscures performance of the system of concern (e.g., an improvement to a portion of a fleet of vehicles may bring major improvement to the vehicle, moderate improvement to the platoon, and only slight improvement to the combined arms team).

i. Higher order measures. DO specify higher order measures (e.g., P_k/percent target kill, percent messages sent and received, A_o/maintenance ratio/MTBOMF (but not all three), etc.)

DON'T specify eaches (e.g., probability of detection, identification, hand-off, engagement, hit, kill given a hit, connectivity, messages received, etc.; RAM characteristics).

j. Baseline comparison. DO specify baseline comparison criteria only when appropriate (see 2.3.4.2b) and state an improvement percentage when the acquisition objective is improved performance and the end result will be higher system cost.

DON'T state an improvement percentage for baseline comparison when cost benefit is the reason for the acquisition.

DON'T use statistical significance as rationale for the stated improvement percentage.

k. Quantitative criteria. DO use quantitative criteria, which are preferred, when possible.

DON'T use qualitative criteria unless quantitative criteria cannot be developed or are not applicable.

l. Lessons learned (recent experiences). DO apply lessons learned from previous evaluations to avoid pitfalls.

DON'T allow duplicate or overlapping criteria (i.e., a system should not be placed in double jeopardy for a single shortcoming).

Section V
Providing the Rationale

3-15. Characteristics

The rationale, by definition, provides justification for the criteria, not the issue, and an audit trail to the requirement specified in the MNS, ROC/ORD, FD, COEA, system specification, etc.. It states the reason for selecting a particular characteristic or capability and identifies, by document and paragraph, the source of the information. In the case of derived criteria, the rationale will provide the basis and methodology used.

3-16. Providing the rationale - Questions to Ask

a. References. Are appropriate source references included for all criteria? Is there an ORD paragraph reference for each criterion stated?

b. Derived criteria. Are the basis and methodology discussed for all "derived" criteria (e.g., probability of kill incorporates probabilities of detection, identification, engagement, hit, and kill given a hit)?

c. COEA relationship. Is the relationship between the criteria and COEA results addressed where applicable (e.g., the ORD requires improved survivability (over that of the baseline system) and the COEA identifies a minimum requirement for 20% more combat capable systems)?

3-17. Providing the rationale - DOs and DON'Ts

a. Criteria justified. DO provide a complete justification for each criteria.

DON'T justify the issue.

DON'T inject new/additional criteria into the rationale.

b. Criteria audit trail. DO establish a complete audit trail by indicating the specific document and paragraph within the document from which the requirement was drawn. Every criteria must have basis in the requirement document (ORD/ROC). This does not mean that it must be a direct lift.

c. Critical mission justification. DO justify why a particular mission or use was selected when multiple missions or uses are possible.

Section VI
Establishing the Notes

3-18. General
Mandatory notes and any other required notes, explanations, or definitions will be included after the last issue set. They serve to: emphasize the purpose and scope of COIC, in relation to the full set of OIC; place T&E results related to COIC in the proper perspective; discuss lengthy T&E conditions or definitions.

3-19. Mandatory note #1

a. The note. Provided the following note modified to reflect appropriate characteristics applicable for the specific system (e.g. if a maintenance ratio included as a criteria then RAM may not apply to this note):

"Note # 1. Criteria X, Y, and Z are total system measures. As such they inherently cover hardware, software, personnel, doctrine, organization, and training. System individual characteristics of operational capability, survivability, RAM, organization, doctrine, tactics, logistics support, training, and MANPRINT (which includes the domains of manpower, personnel, training, human factors engineering, system safety, and health hazards) related to these criteria will be provided by the operational independent evaluator in the Operational Test and Evaluation Plan (TEP)."

a. Discussion of note #1.

(1) This note serves to emphasize to the COIC developer that total system measures are preferred.

(2) This note acknowledges that some criteria will not be total system measures, and identifies for the evaluator and

reviewers those designated criteria (X, Y, and Z) which are in fact total system measures.

(3) This note commits to addressing the more detailed system individual characteristics in the operational TEP.

3-20. Mandatory note #2

a. The note. Provide the following note:

"Note # 2. Criteria are not provided as automatic (default) pass/fail measures. Rather they represent estimates of performance for which a breach would require a careful senior level management reassessment of cost effectiveness and program options during the program milestone decision review."

b. Discussion of note # 2.

(1) This note emphasizes that criteria are not "automatic" pass/fail measures.

(2) This note highlights the fact that breach of a criteria constitutes a show stopper until convincing evidence can be presented to decision makers that the program should proceed in spite of the shortfall. "Convincing evidence" might include a revised risk assessment, specific observations and data from operational tests, baseline comparison data, COEA updates, or a revised threat assessment.

3-21. Mandatory note #3.

a. The note. Provide the following note for those COIC applicable to the MS I TEMP:

"Note # 3. These COIC are derived from the user's initial requirements for the system. These COIC will be updated prior to MS II based on the revised ORD and final updated COEA."

b. Discussion of note #3,

(1) This note is applicable only for COIC in support of the TEMP approved in advance of Milestone I.

(2) This note highlights the fact that COIC for the MS I TEMP may contain "soft" criteria which will be updated as the system matures.

3-22. System peculiar notes
System peculiar notes are those necessary for understanding They will commonly focus on definitions or lengthy test and evaluation conditions.

Section VII
COIC Checklist and Development Sample

3-23. Checklist for COIC

Figure 3-11 is a COIC checklist for use by COIC preparers and staffers at all levels. The checklist covers both content and processing events. Materiel and IMA systems are covered.

3-24. COIC development sample

Figure 3-12 is a COIC development sample. There are two parts - the situation and the solution. The situation provides applicable operational requirements information, program status, similar system recent experience, and acquisition strategy. The solution provides a resultant set of COIC for the situation described applying the guidelines presented in this guide. There are other possible solutions but note that this has been successful.

*************INSERT FIGURE 3-11***************

*************INSERT FIGURE 3-12***************

EVENT	ACAT I/II MAT, T/T MAISRC AIS, & OSD T&E OVERSIGHT NLT DAYS PRIOR TO MS I	MS II	ACAT III/IV MAT & NON-MAISRC T/T AIS NLT DAYS PRIOR TO MS I	MS II
CBTDEV APPROVED ORD	185	230	120	120
DA APPROVED ORD	125	170	N/A	N/A
CBTDEV APPROVED COIC	95	140	75	75
DA APPROVED COIC	N/A	100	N/A	N/A
COIC TO MATCEV	95	95	75	75
MATDEV APPROVED TEMP	65	65	45	45
DA APPROVED TEMP	45	45	N/A	N/A

Table 2-1. Synchronized Process Schedules: MS I/II

EVENT	NLT DAYS PRIOR TO DA TEMP APPROVAL
CBTDEV APPROVED RQMT CHANGE	185
DA APPROVED RQMT CHANGE	125
CBTDEV APPROVED COIC	95
DA APPROVED COIC	55
COIC TO MATDEV	50
MATDEV APPROVED TEMP	20
DA APPROVED TEMP	0

Table 2-2. Synchronized Process Schedule: Post-MS II Changes

EVENT	NLT DAYS PRIOR TO MDR I
FP APPROVED COIC	140
SAIS-AE APPROVED COIC	100
VDISC4 APPROVED COIC	93
COIC TO PM/TIWG	79
MATDEV/SFTDEV APPROVED TEMP	65
DUSA(OR) APPROVED TEMP	45

Table 2-3. Synchronized Process Schedule:
Strategic and Sustaining Base (S/SB) IMA COIC/TEMP

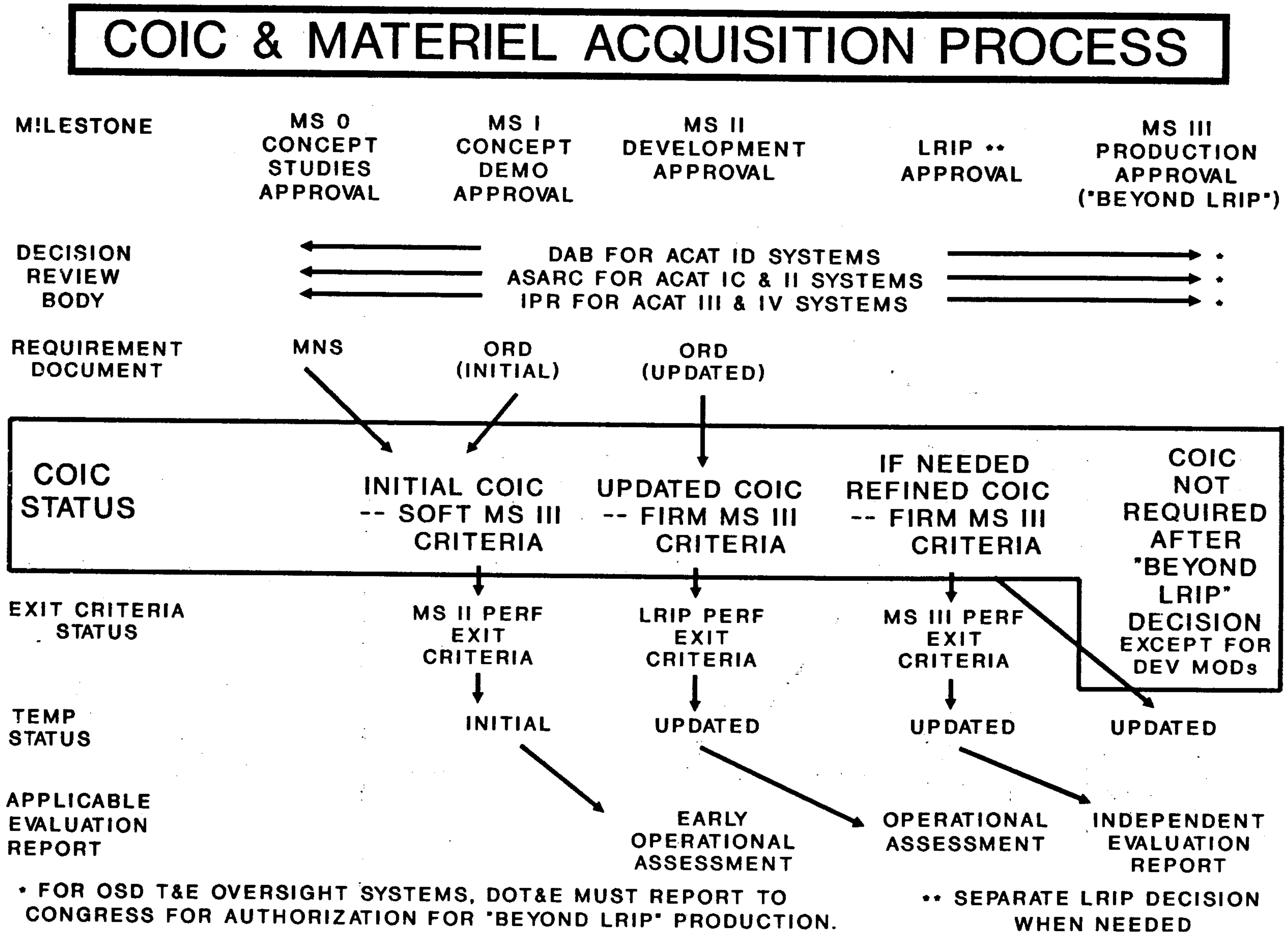


FIGURE 2-1. COIC and the Materiel Acquisition Process

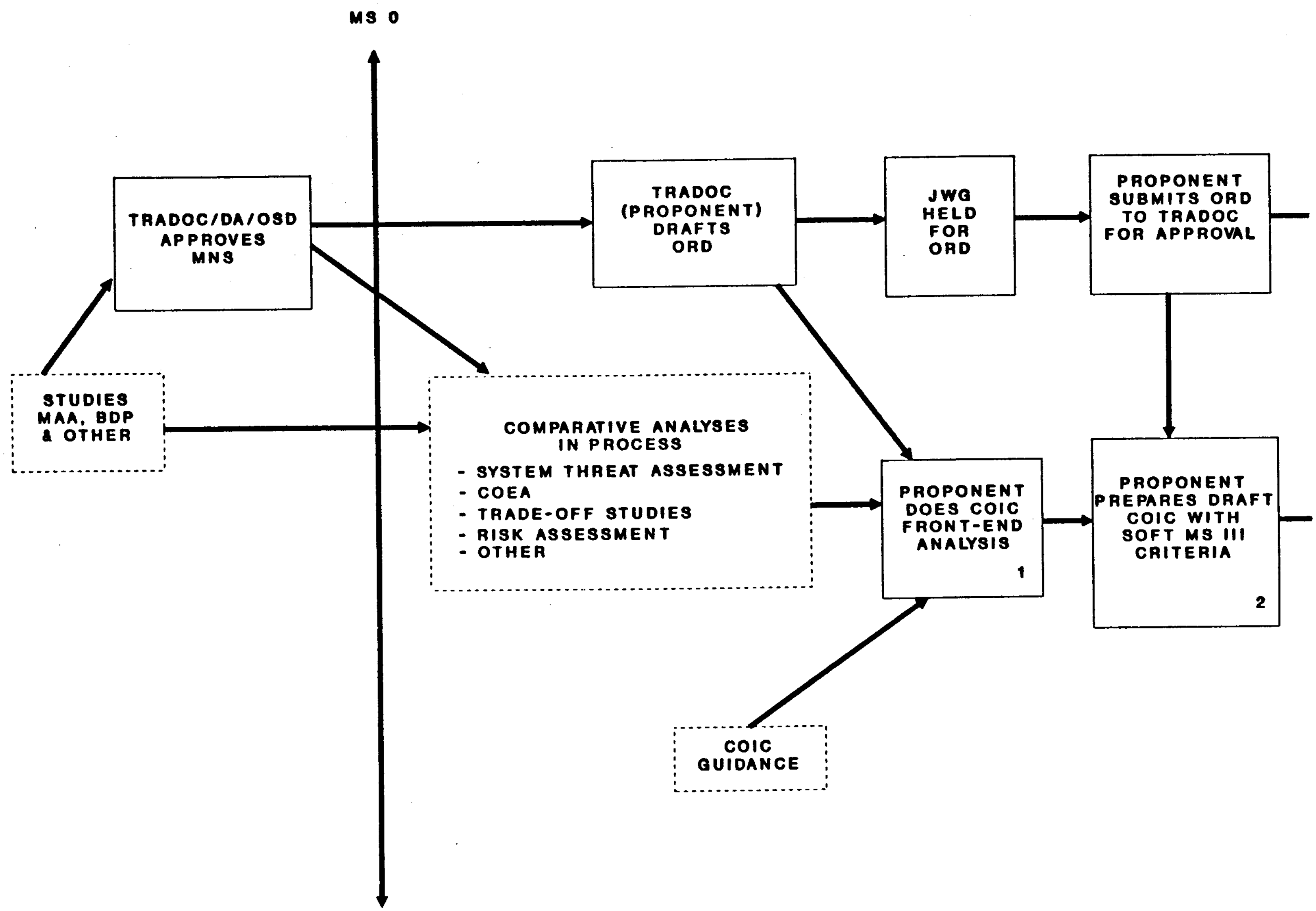
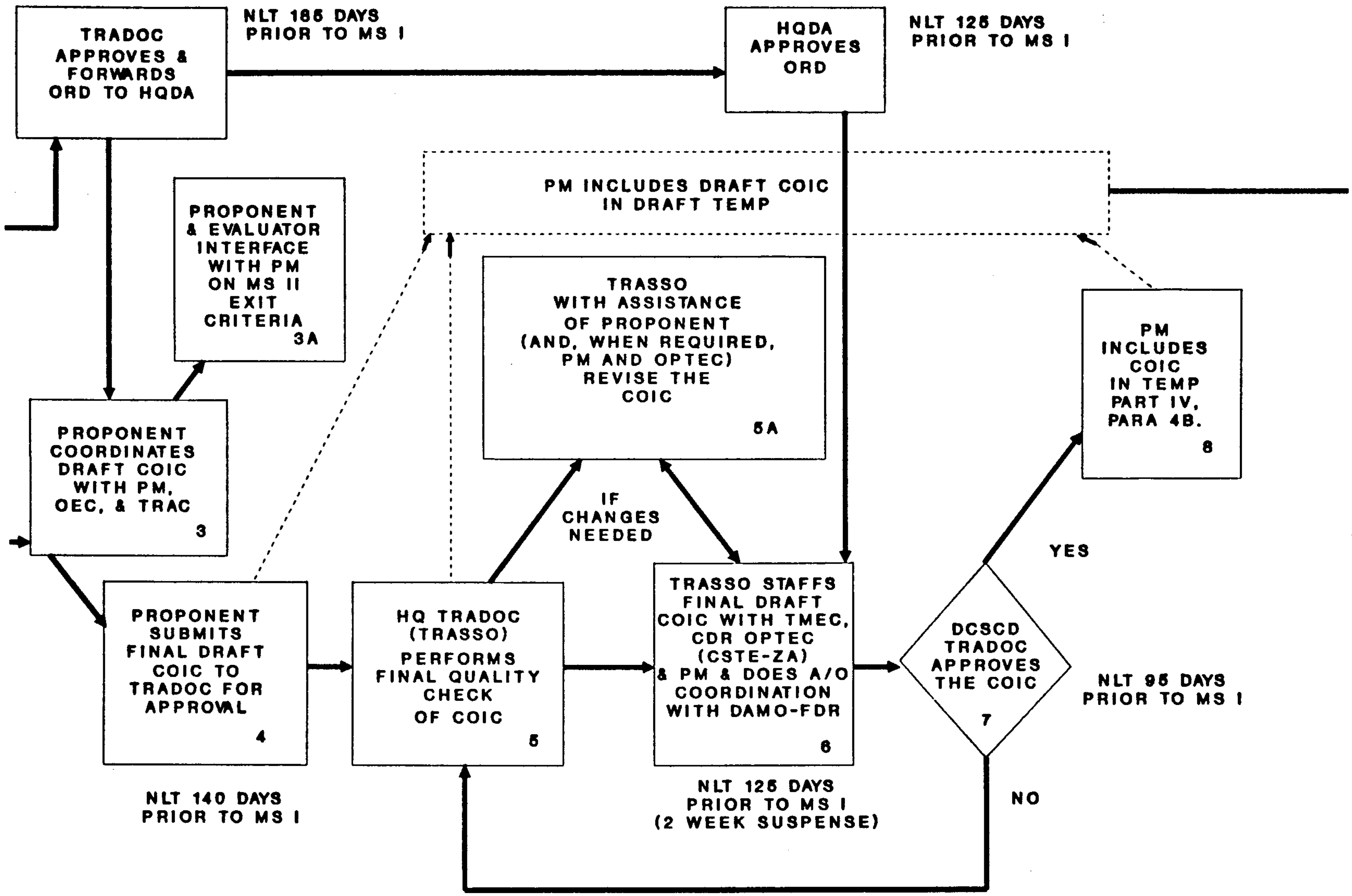


Figure 2-2. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 1 & 2 of 30



NOTE: FOR ACAT ID PROGRAMS, ADD 15 DAYS TO EACH NLT TIME INDICATED

Figure 2-3. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 3 through 8 of 30

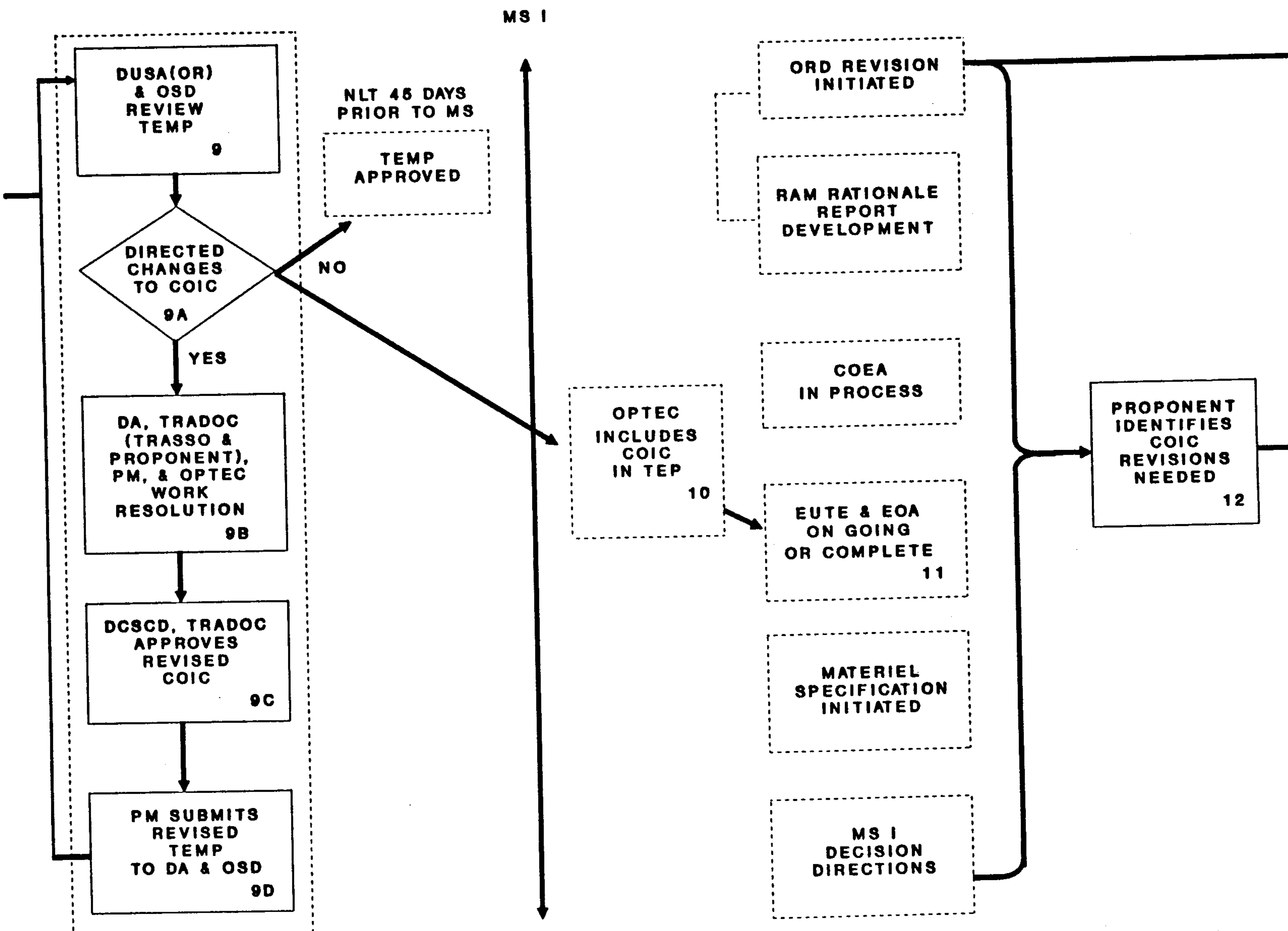


Figure 2-4. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 9 through 12 of 30

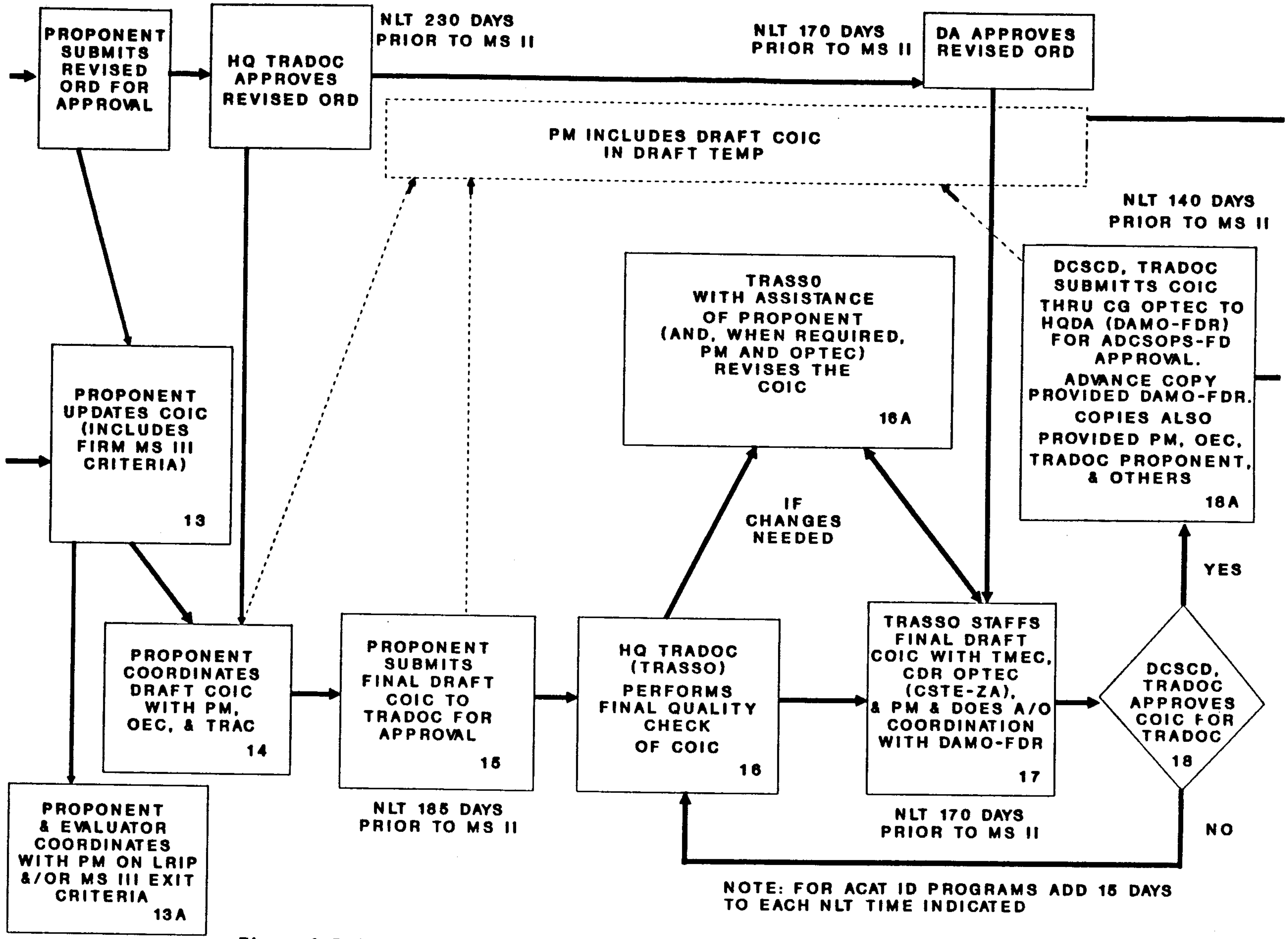


Figure 2-5. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 13 through 18 of 30

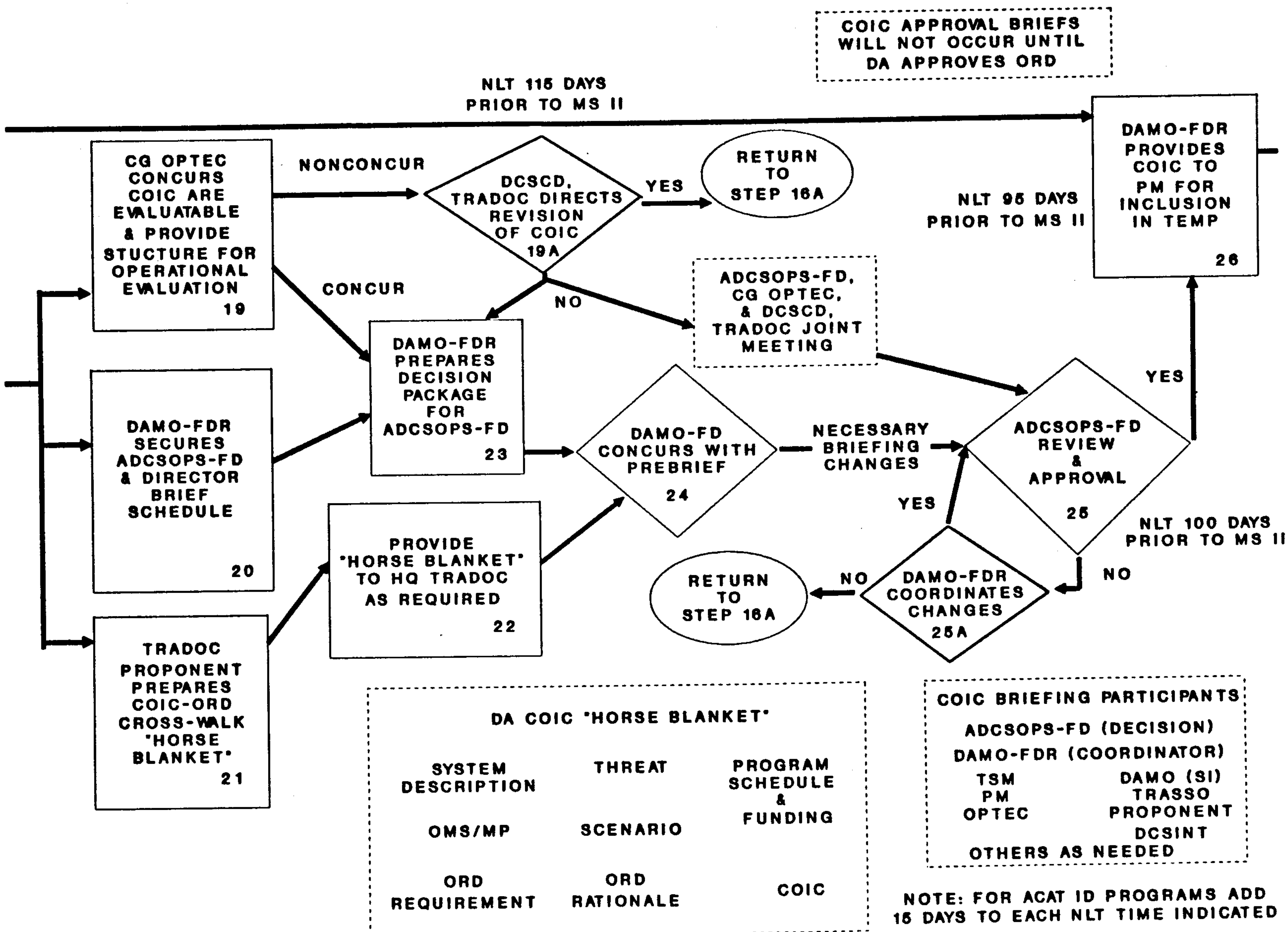


Figure 2-6. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 19 through 26 of 30

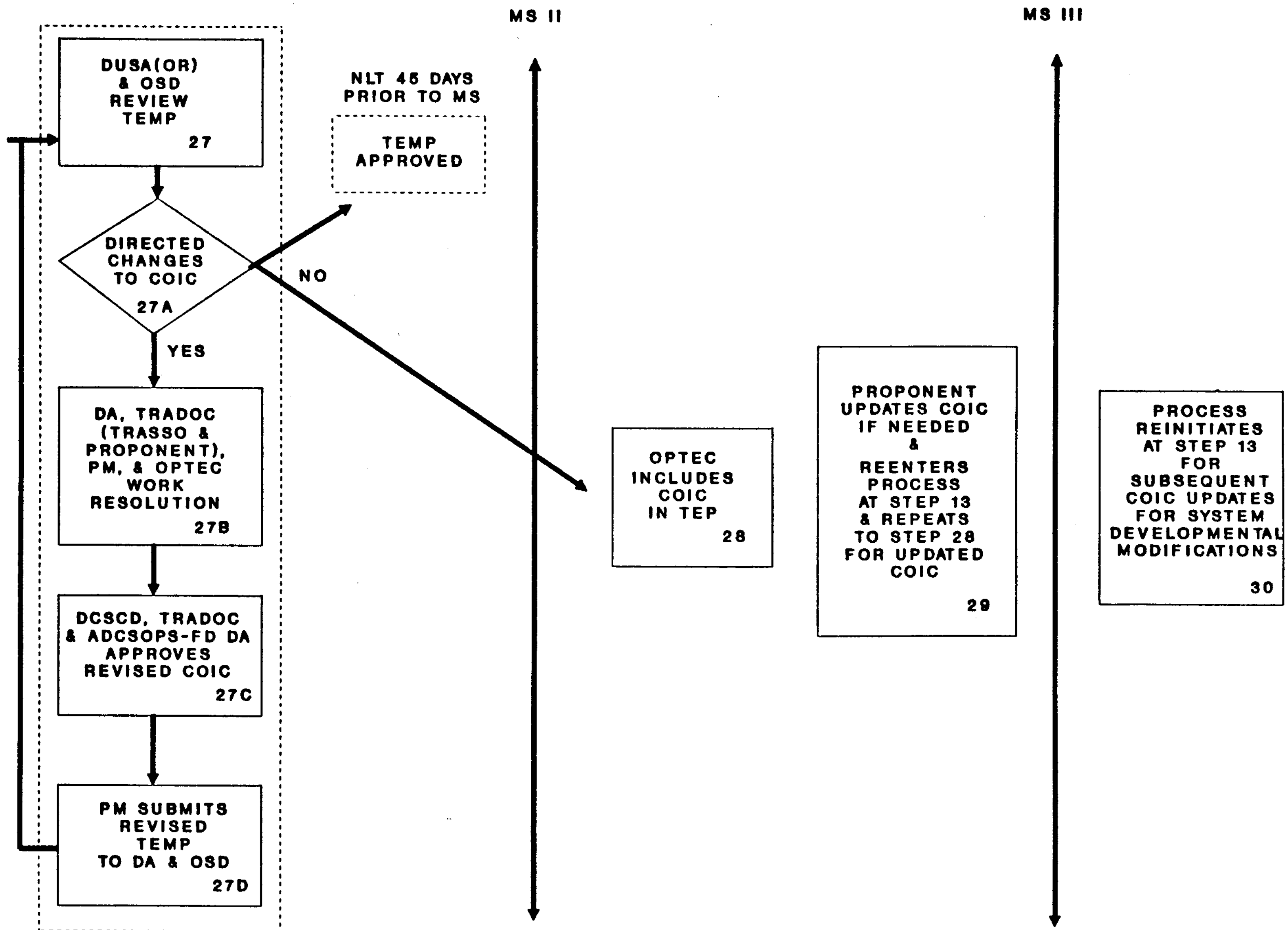


Figure 2-7. Process for ACAT I/II Materiel, Theater/Tactical (T/T) MAISRC AIS, OSD T&E Oversight, and Other Systems Selected for HQDA DCSOPS-FD Approval - Steps 27 through 30 of 30

U.S. Army Training and Doctrine Command

ATCD-ZZ (71-3) S: ZZZZZZZZ

MEMORANDUM FOR CDR OPTEC, ATTN: CSTE-ZA (EVALUATOR'S NAME)
PM
HQDA, ATTN: DAMO-FDR
TRADOC MATERIEL EVALUATION COMMITTEE (TMEC)

SUBJECT: Critical Operational Issues and Criteria (COIC) for "X" System

1. References:

a. Memorandum, HQDA, DUSA(OR) and ADCSOPS-FD, 3 Jun 92, subject: Critical Operational Issues and Criteria (COIC).

b. Message, HQDA, DAMO-FDZ, 091515Z May 91, subject: HQDA Approval Procedures for Materiel System Critical Operational Issues and Criteria (COIC).

2. This memorandum forwards final draft COIC for subject system for your concurrence. Per references 1a and b above, this constitutes TRADOC position staffing to recommend that DCSCD approve and forward these COIC to DA for ADCSOPS-FD approval. Request your position be provided this headquarters (ATTN: ATCD-M/G/S) not later than (two weeks) . This will support TEMP approval by (date) as currently scheduled.

3. Significant changes will be staffed with you before DCSCD approves the COIC for TRADOC. An expedited staffing technique will be used to maintain current approval schedule.

4. TRADOC POC is YYYYYYYYYYYY.

FOR THE COMMANDER:

1 Encl
as

XXXXXXXXXXXXXXXXXXXXXXXXX
Major General, GS
Deputy Chief of Staff for
Combat Developments

CF:
TRADOC COMMAND/CENTER/SCHOOL, ATTN: DCD AND TSM

Figure 2-8. Sample Combat Developer Final COIC Staffing Memorandum -- Before Forwarding to DA for Approval

U.S. Army Training and Doctrine Command

ATCD-ZZZ (71-3)

MEMORANDUM THREW COMMANDER, U.S. ARMY OPERATIONAL TEST AND EVALUATION COMMAND, ATTN: CSTE-ZA, PARK CENTER IV 4501 FORD AVENUE, ALEXANDRIA, VA 22302-1458

FOR HQDA, ATTN: DAMO-FDR, WASHINGTON, D.C. 20310-0400

SUBJECT: Critical Operational Issues and Criteria (COIC) for "X" System

1. References:

a. Memorandum, HQDA, DUSA(OR) and ADCSOPS-FD, 3 Jun 92, subject: Critical Operational Issues and Criteria (COIC).

b. Message, HQDA, DAMO-FDZ, 091515Z May 91, subject: HQDA Approval Procedures for Materiel System Critical Operational Issues and Criteria (COIC).

2. This memorandum forwards TRADOC approved COIC for subject system (Encl 1) for ADCSOPS-FD approval per references 1a and b. These COIC were previously staffed with and concurred in by PM and OPTEC. .... (If there is an unresolved difference of position, it should be described here.) ....

3. TRADOC POC is YYYYYYYYYYYY.

FOR THE COMMANDER:

1 Encl
as

XXXXXXXXXXXXXXXXXXXXXXXXX
Major General, GS
Deputy Chief of Staff for
Combat Developments

CF:
HQDA, ATTN: DAMO-FDR (ADVANCE COPY)
OPERATIONAL EVALUATION COMMAND, ATTN: Evaluator Office
PM
TRADOC CENTER/SCHOOL, ATTN: DCD AND TSM

Figure 2-9. Sample Combat Developer Memorandum Forwarding COIC to DA for Approval

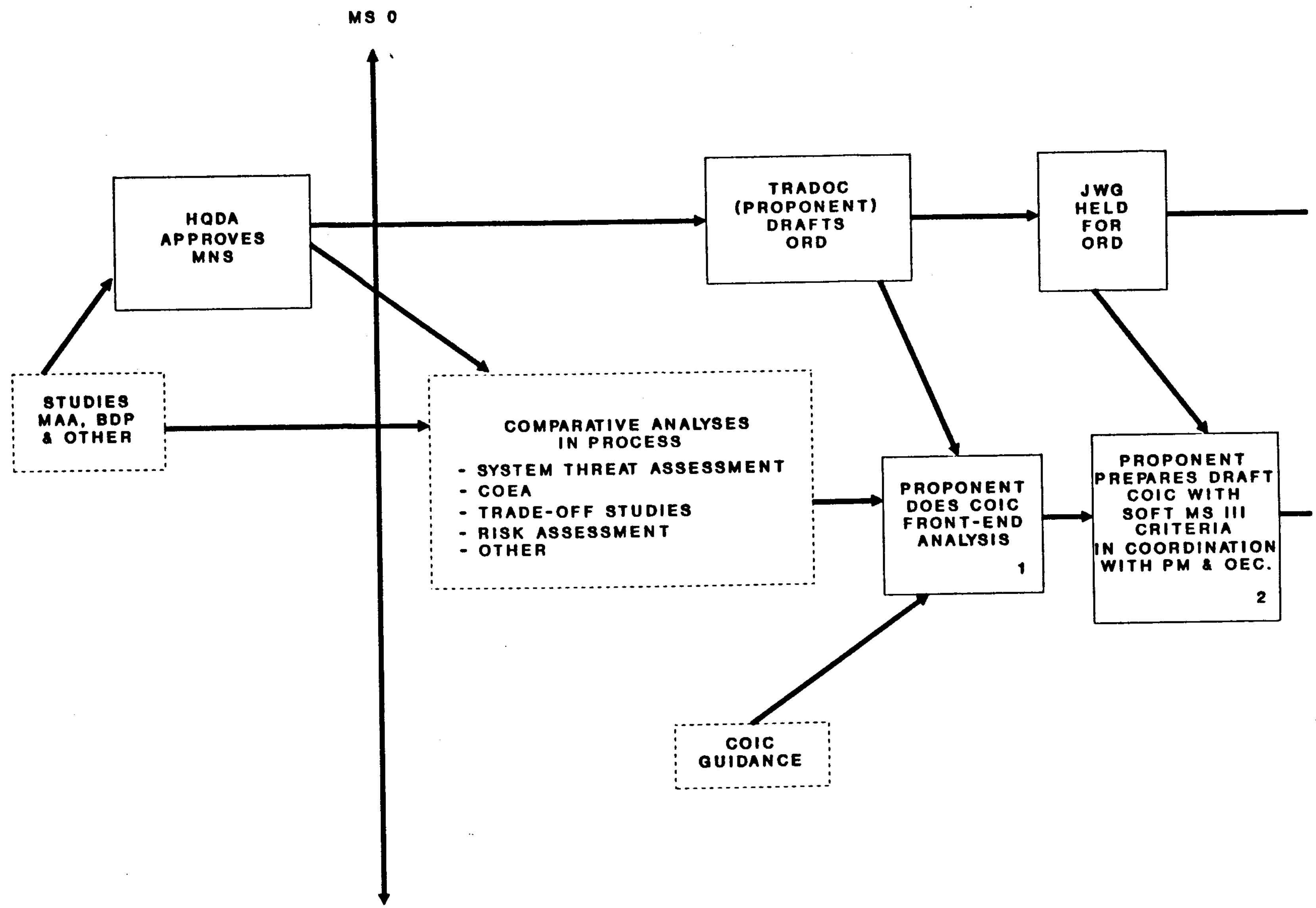


Figure 2-10. Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on the OSD T&E Oversight List - Steps 1 & 2 of 17

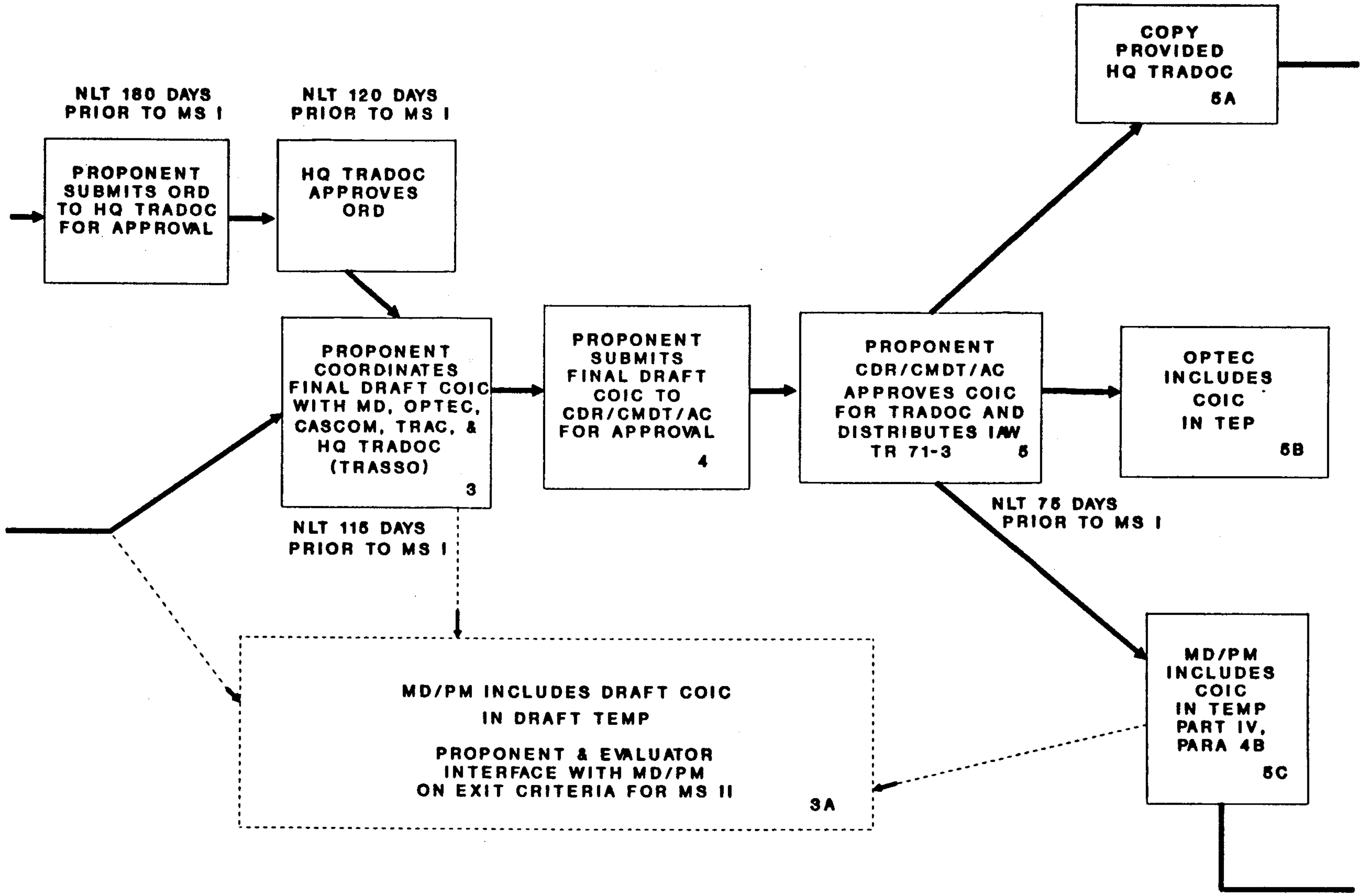


Figure 2-11. Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on the OSD T&E Oversight List - Steps 3 through 5 of 17

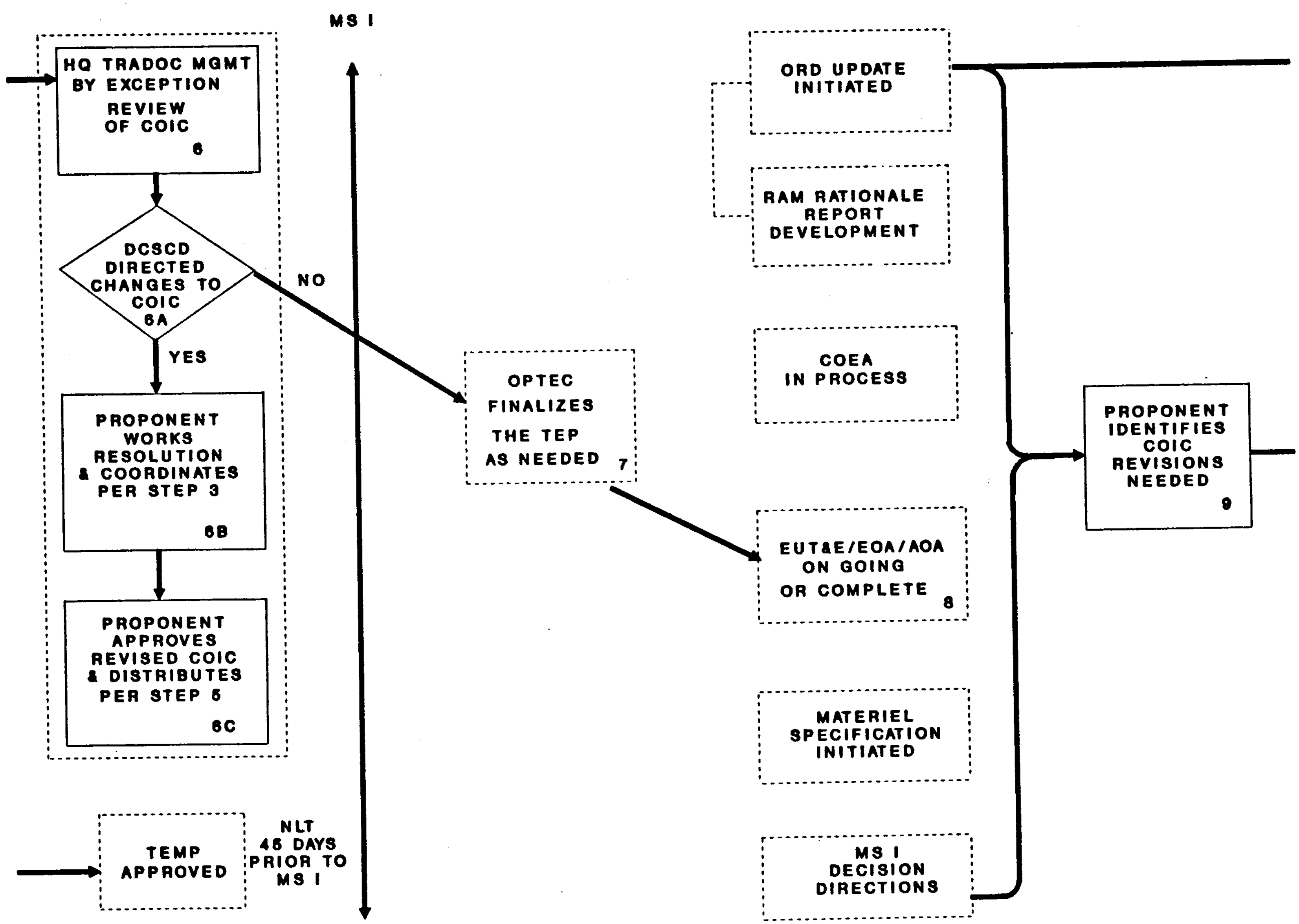


Figure 2-12. Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on the OSD T&E Oversight List - Steps 6 through 9 of 17

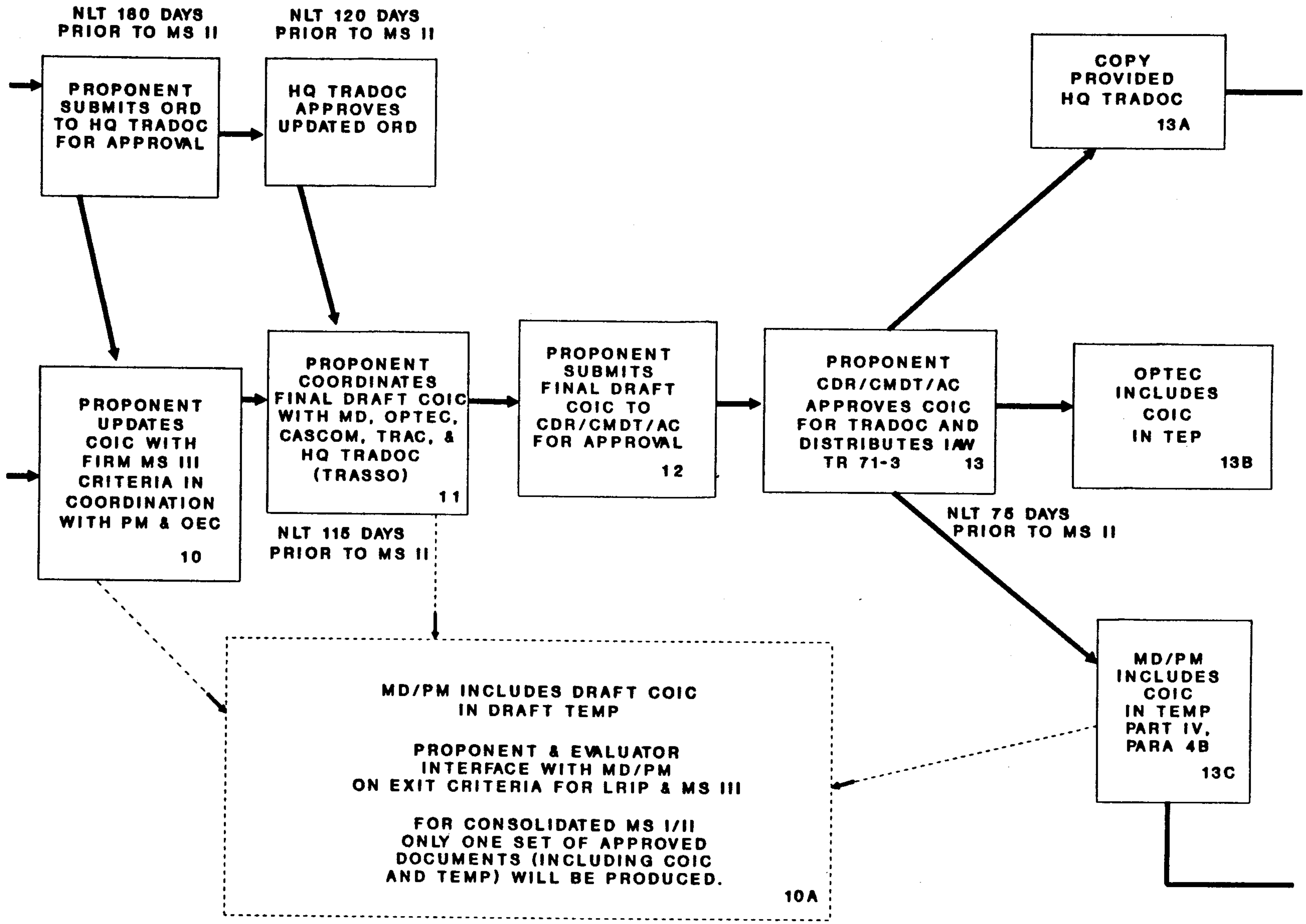


Figure 2-13. Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on the OSD T&E Oversight List - Steps 10 through 13 of 17

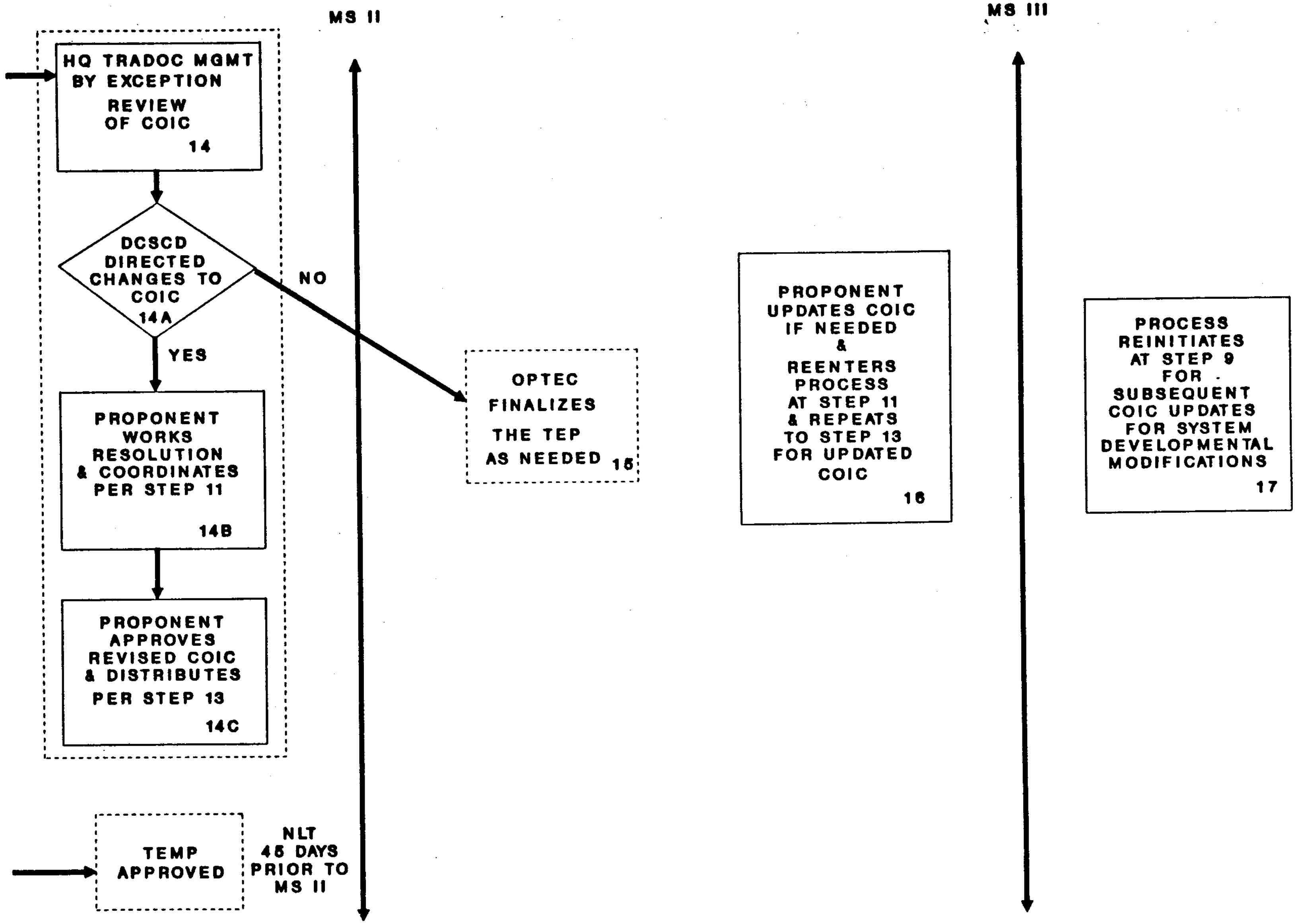


Figure 2-14. Process for ACAT III/IV Materiel and Theater/Tactical (T/T) Non-MAISRC IMA Systems not on the OSD T&E Oversight List - Steps 14 through 17 of 17

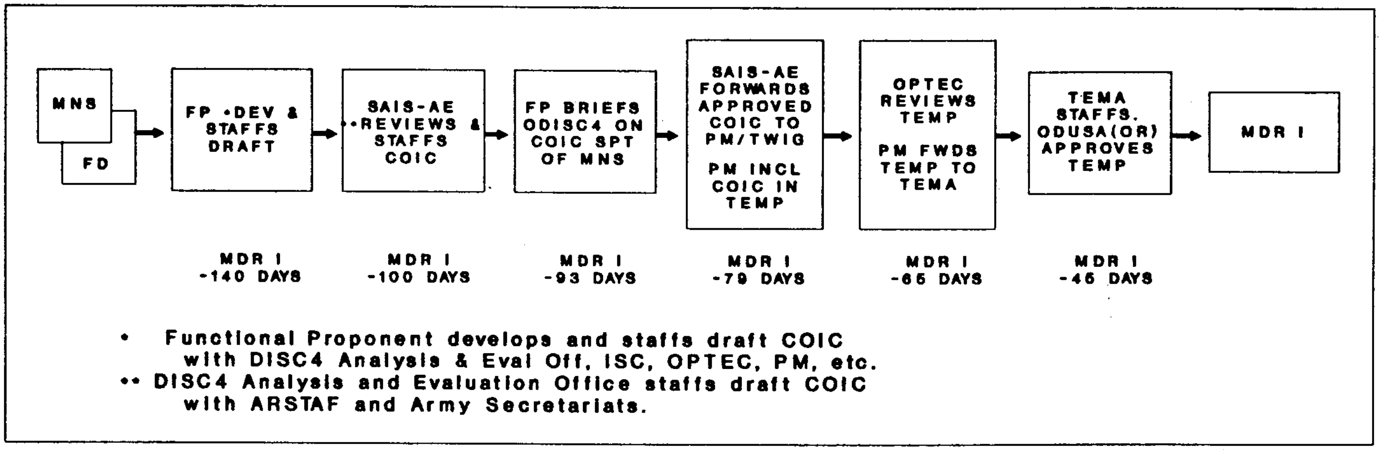
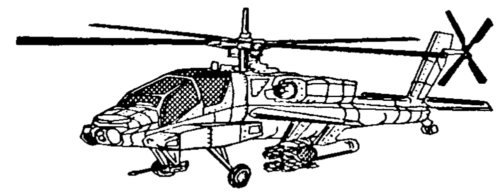


Figure 2-15. COIC Process for Strategic and Sustaining Base (S/SB) Information Mission Area (IMA) Systems

SYSTEM "X" COIC LAYDOWN

SYSTEM DESCRIPTION

MISSION PROFILE



THREAT

PROGRAM FUNDING

OPERATIONAL MODE SUMMARY

OPERATIONAL SCENARIO

PROGRAM SCHEDULE

Figure 2-16. COIC-ORD Crosswalk Horse Blanket Page 1

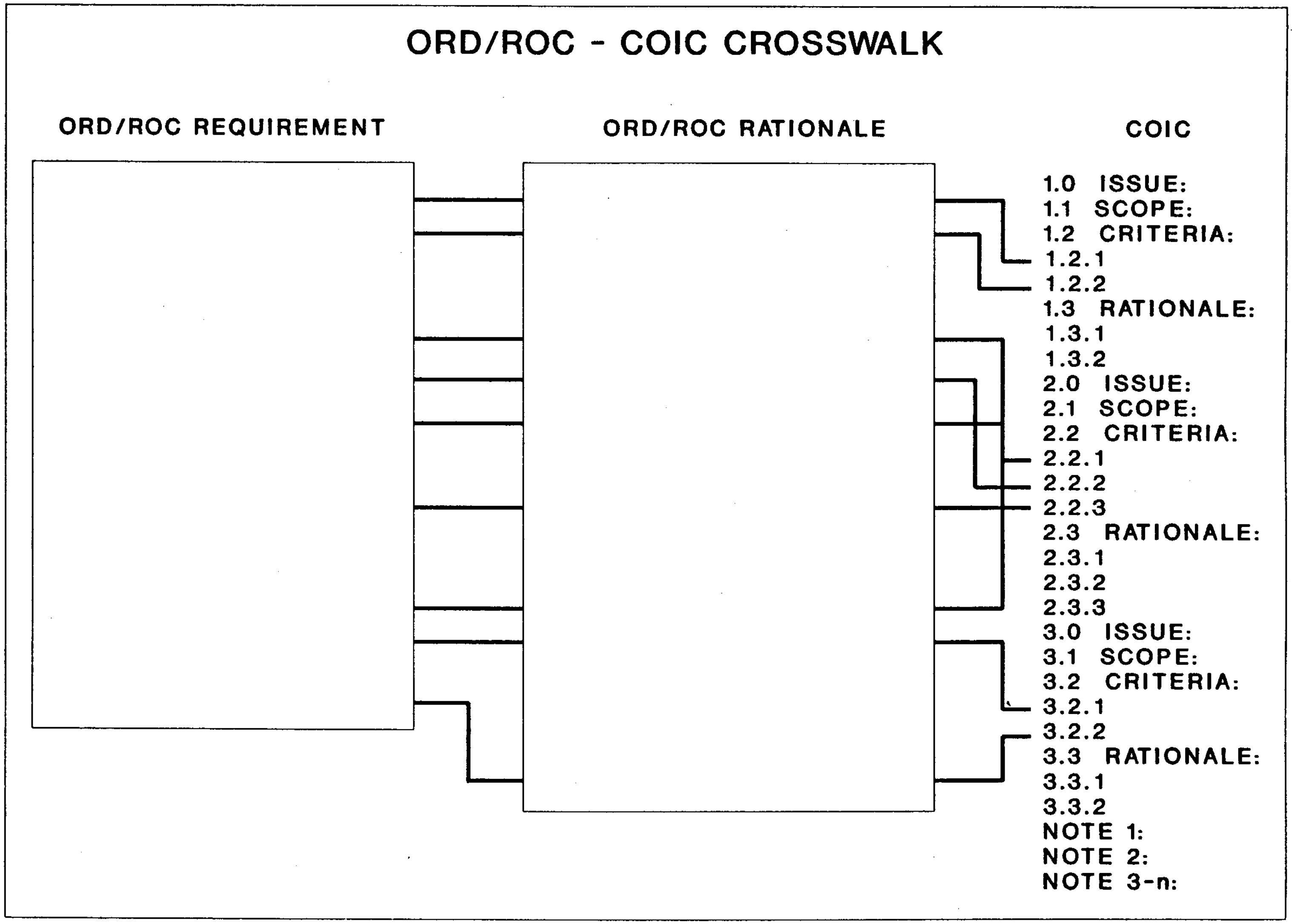


Figure 2-17. COIC-ORD Crosswalk Horse Blanket Pages 2-n

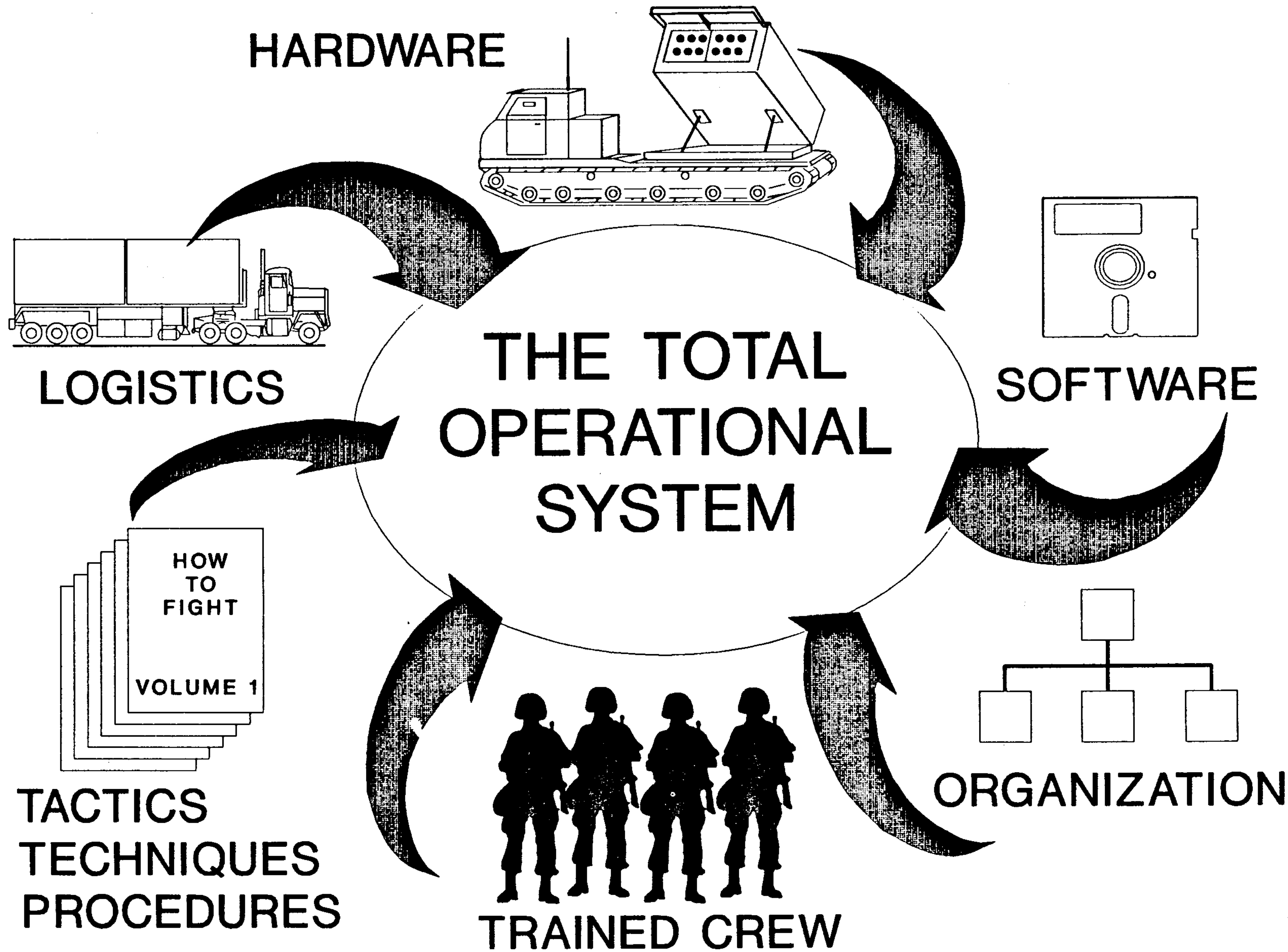


Figure 3-1. The Total Operational System

Critical Operational Issues and Criteria
for
the "X" System (or "Y" Modification to the "X" System)
for Test and Evaluation Master Plan Supporting
Milestone "Z" (I/II/III) or Modification Approval Package

1.0 <u>Issue</u>: (See Section II)

1.1 <u>Scope</u>: (See Section III)

1.2 <u>Criteria</u>: (See Section IV)

1.2.1

1.2.2

1.2.n

A dendritic numbering system is used to standardize format.

1.3 <u>Rationale</u>: (See Section V)

1.3.1

1.3.2

1.3.n

Rationale subparagraphs correspond to those of each criteria.

Subsequent issue sets are numbered 2 through n. NOTE: the total is commonly six (6) or less, with three (3) being the norm.

Note 1: (mandatory) (See Section VI)

Note 2: (mandatory) (See Section VI)

Note 3: (mandatory for MS I TEMP COIC) (See Section VI)

Notes 4 through n (system peculiar - see Section VI)

Figure 3-2. COIC Format

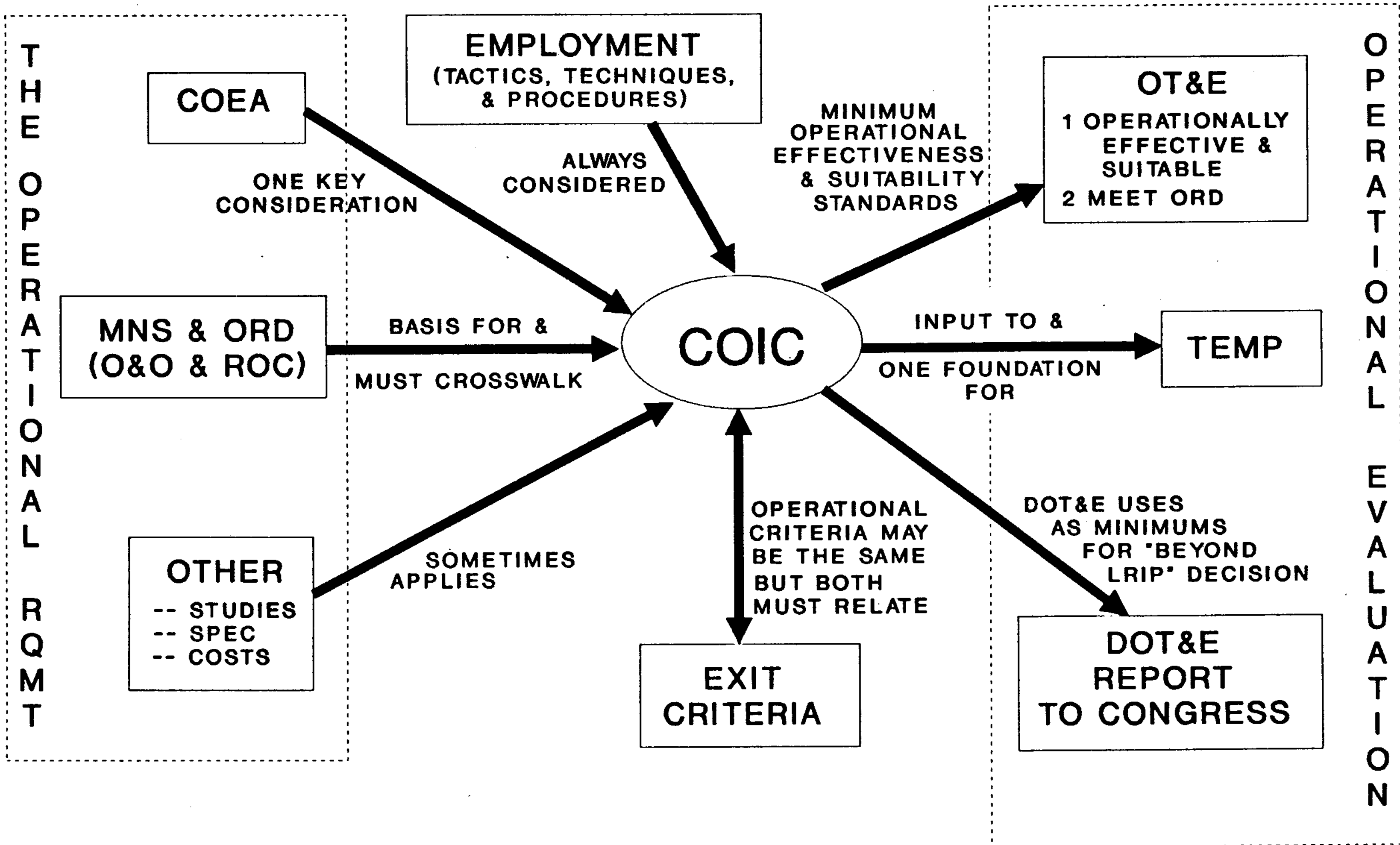


Figure 3-3. COIC Relationships

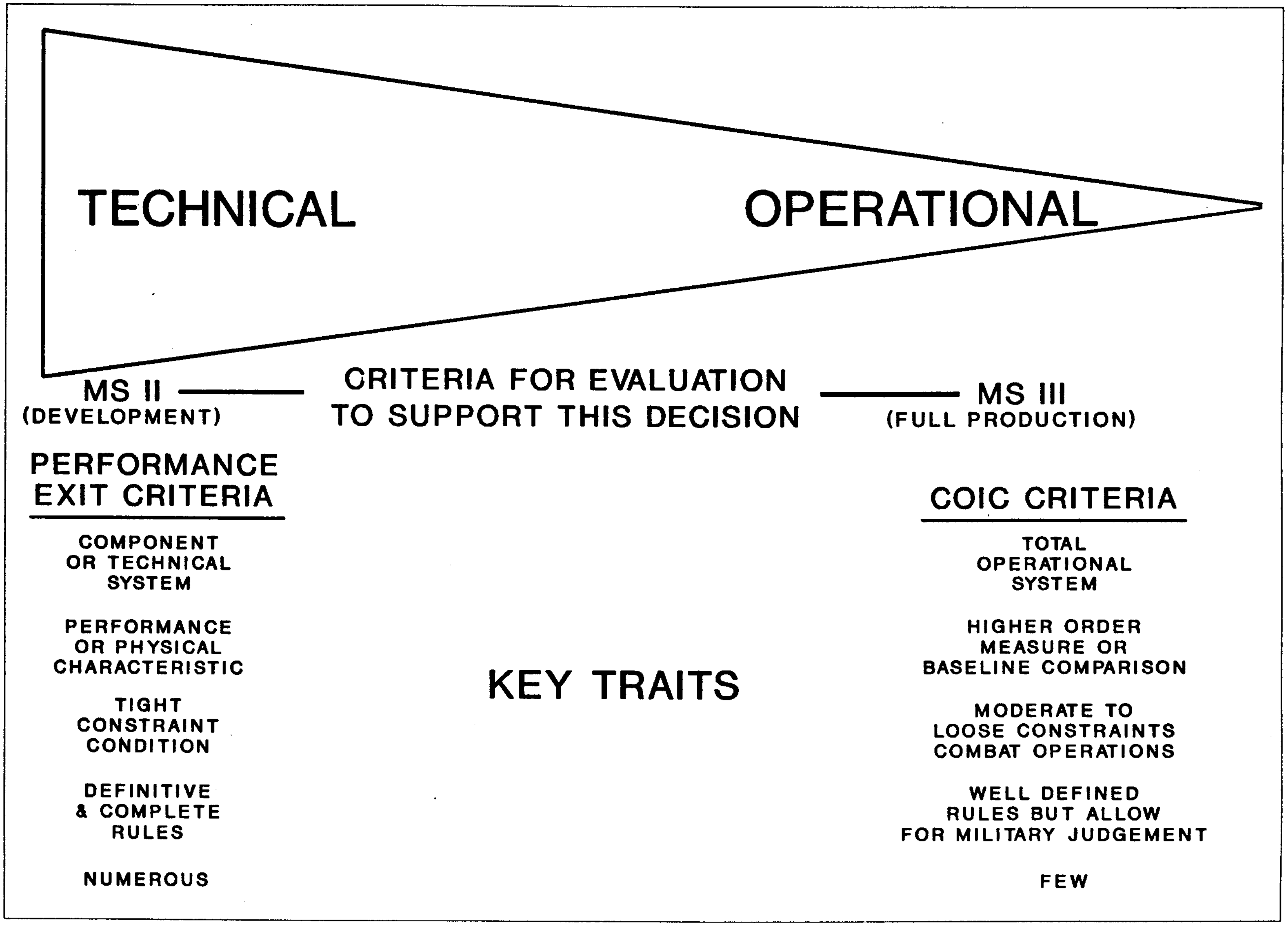


Figure 3-4. COIC VS Performance Exit Criteria

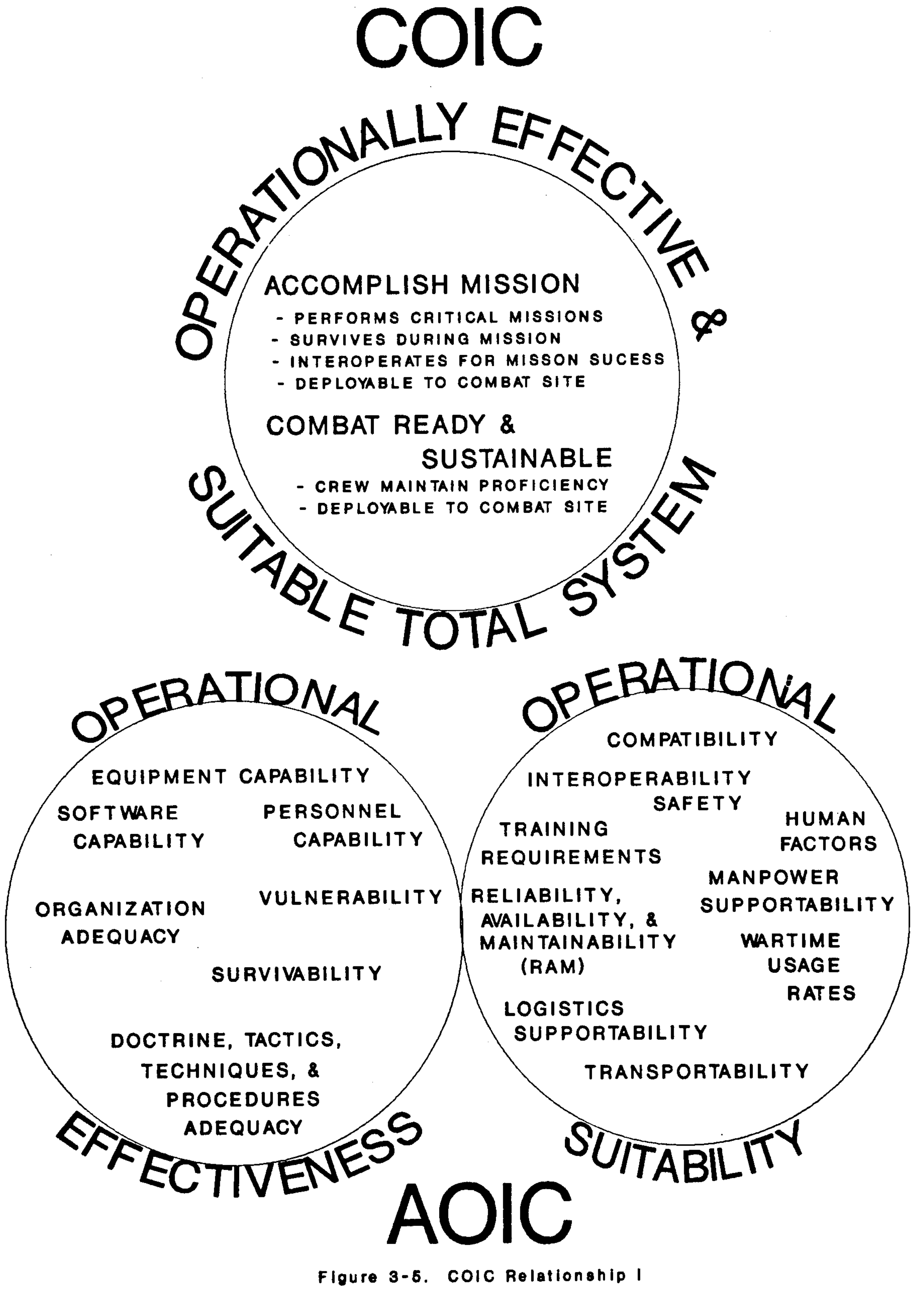


Figure 3-5. COIC Relationship I

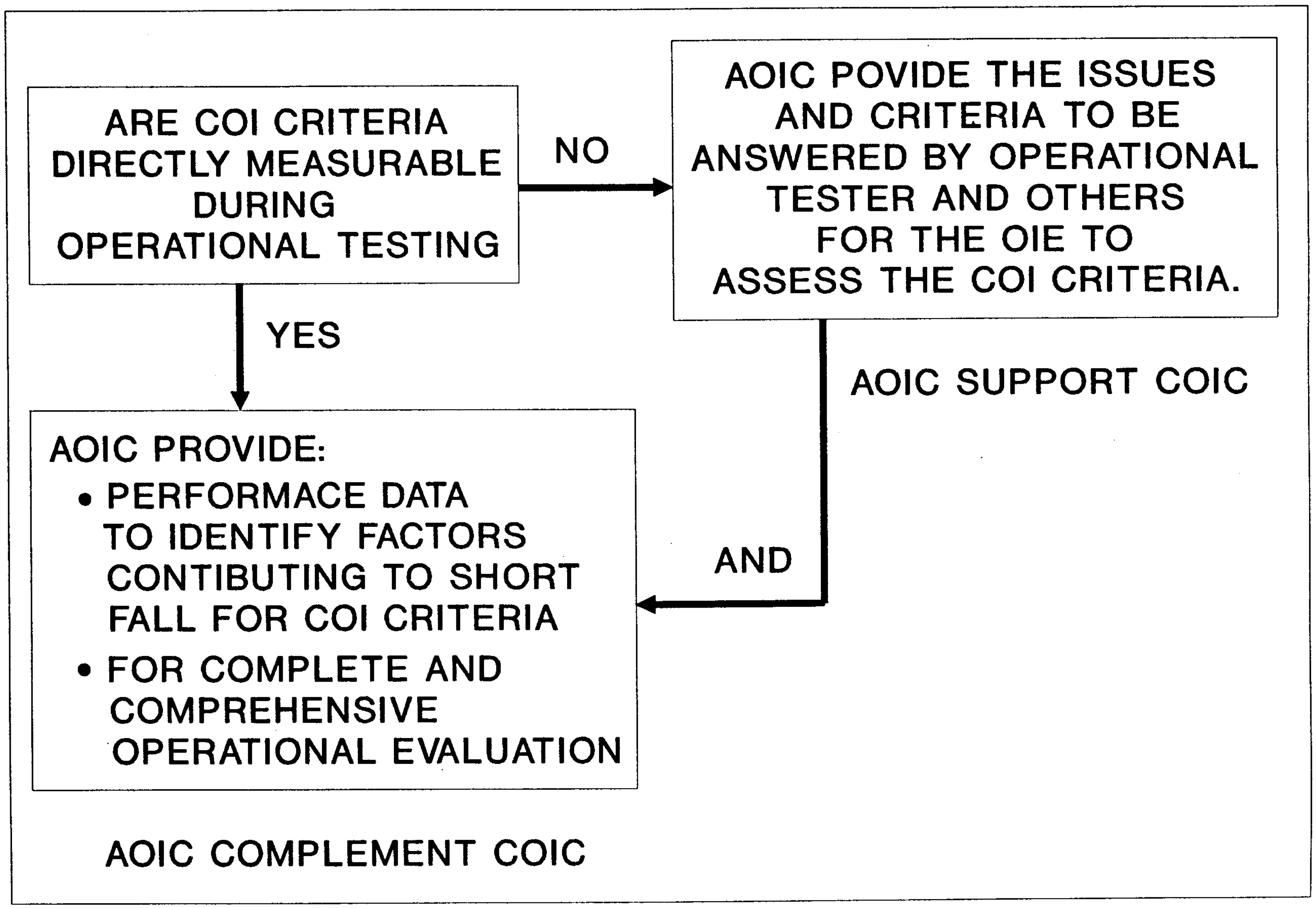


Figure 3-6. COIC-AOIC Relationship II

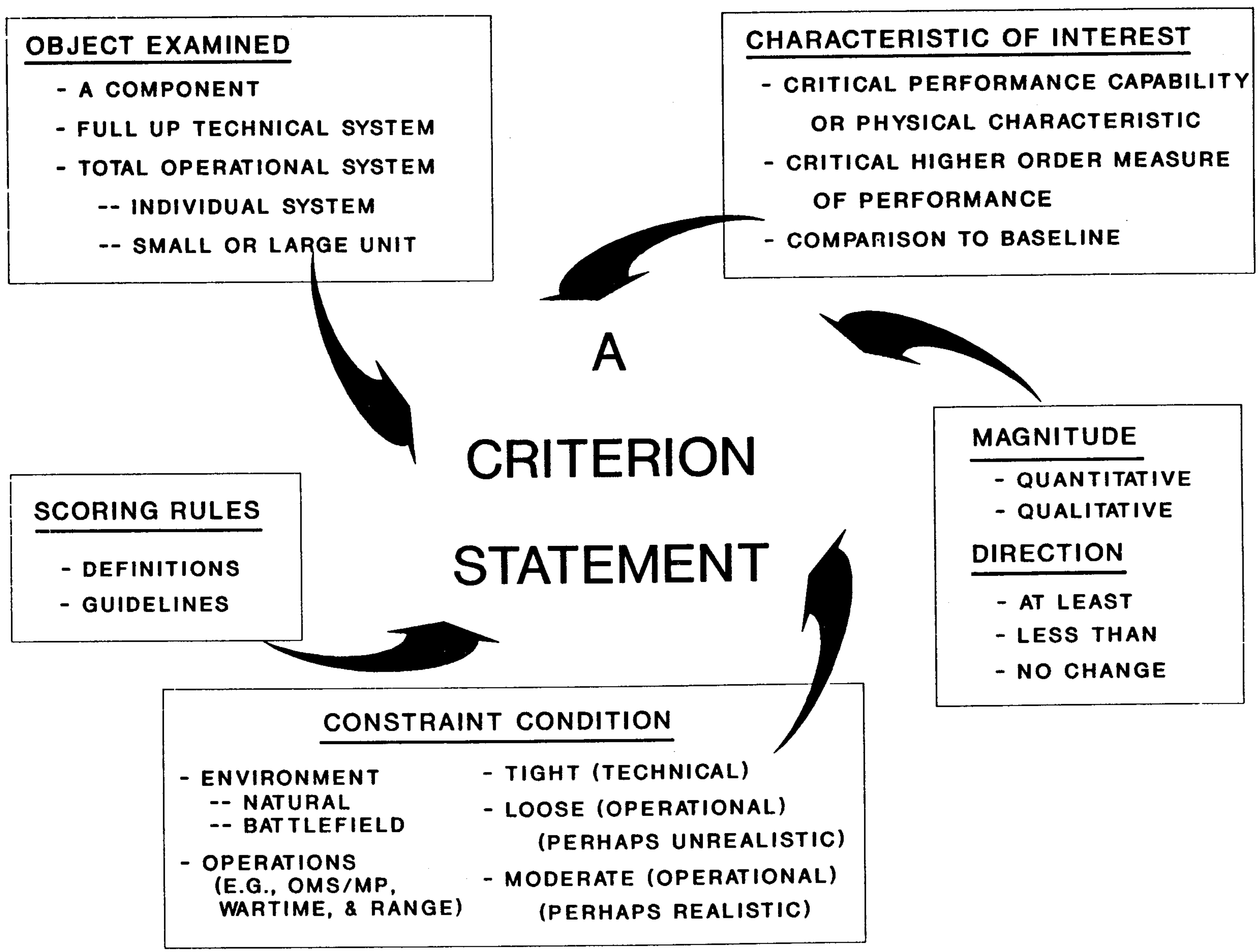


Figure 3-7. A Criterion Statement

SITUATION	MEASURE
AUTOMATED INFORMATION SYSTEM	-QUALITY & TIMELINESS OF CRITICAL FUNCTION(S) ACCEPTABLE TO USER
NETTED COMMUNICATIONS SYSTEM	-PERCENT PRIORITY COMMUNICATIONS ACCEPTABLY PASSED BY THE NET
SYSTEM SURVIVABILITY IMPROVEMENT WITH RAM TRADE-OFF	-PERCENT MORE COMBAT CAPABLE SYSTEMS AVAILABLE DURING A PERIOD OF COMBAT OPERATIONS
AIR DEFENSE WEAPON SYSTEM	-PERCENT OF THREAT A/C KILLED -PERCENT FRIENDLY A/C ENGAGED
TRUCK SYSTEM	-SAFE TRANSPORT PAYLOAD IAW OMS/MP -PROBABILITY OF SAFE LOAD/UNLOAD
SURVIVABILITY IMPROVEMENT	-PERCENT OF TARGETS ENGAGED/KILLED -PERCENT OF ENGAGEMENTS BY THREAT

Figure 3-8. Characteristics of Interest - Mission Accomplishment Examples

SITUATION	MEASURE
NEW WARHEAD FOR EXISTING "WOODEN" ROUND	-NO SUSTAINMENT ISSUE
SUSTAINMENT TRAINING (NORMAL CONSIDERATION)	-ABILITY TO DO CREW DRILLS AND TRAINING IN GARRISON OR -OPERATORS/CREWS PERFORM OPERATIONS ACCEPTABLY WITH ONLY EXPORTABLE TRAINING
SUSTAINMENT LOGISTICS (NORMAL CONSIDERATIONS)	-SUSTAIN THE SYSTEM FOR X DAYS COMBAT OPERATIONS OR -PERCENT OF COMBAT CAPABLE SYSTEMS AFTER REASONABLE DURATION

Figure 3-9. Characteristics of Interest - Sustainment Examples

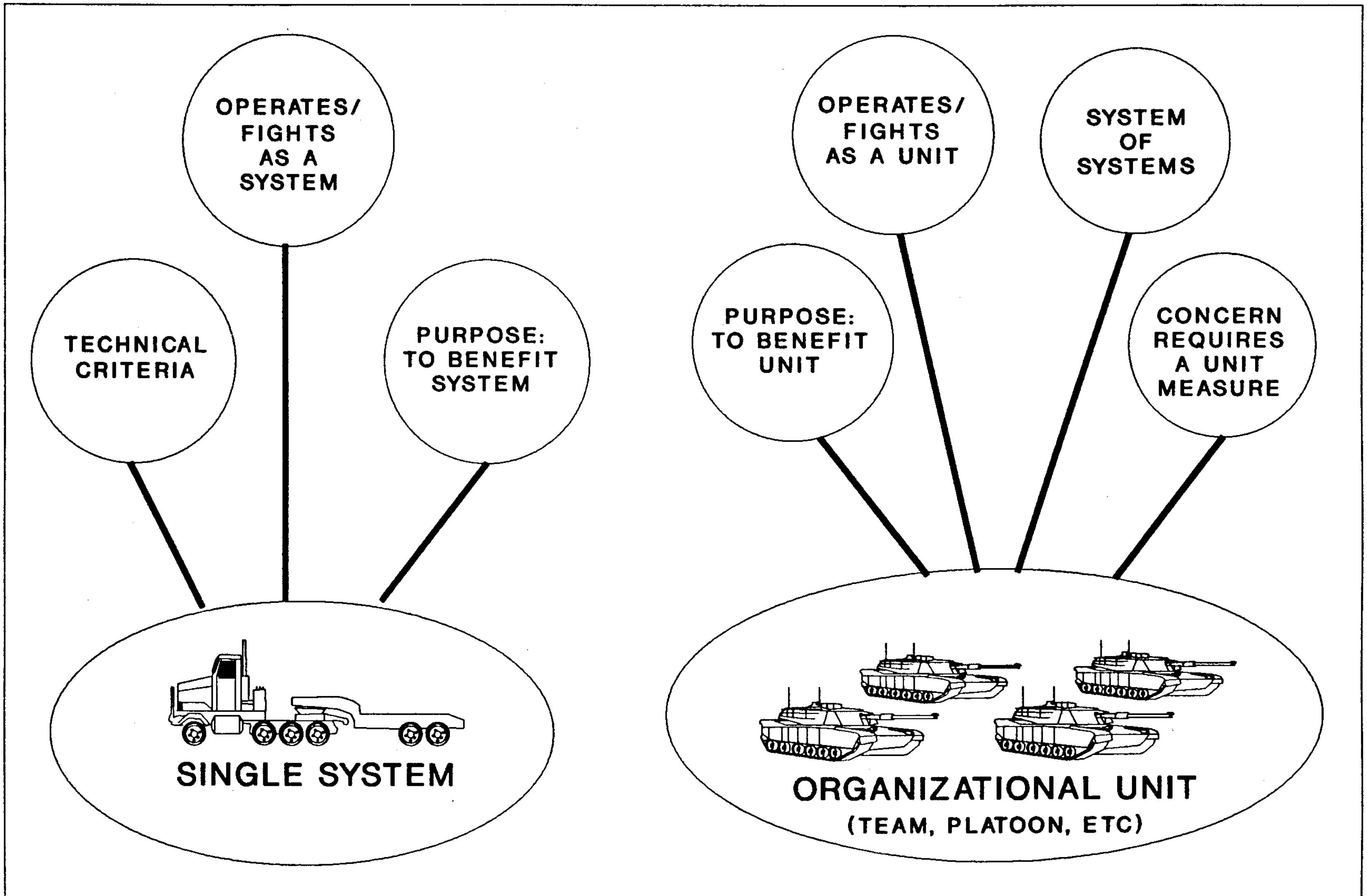


Figure 3-10. Which Total Operational System

Checklist for
Critical Operational Issues and Criteria (COIC)

NOTE: This checklist is provided to be followed as a guideline for use by all involved in the preparation, review, and approval of Critical Operational Issues and Criteria (COIC). All questions are intended to be answered "yes." If a question is answered "no," the applicable element should be reworked or justification provided. Approved COIC are included in the Test and Evaluation Master Plan (TEMP).

1. COIC Format and Content.

a. Heading.

(1) Does it state "Critical Operational Issues and Criteria for"?

(2) Does it contain the system name?

(3) Does it identify the applicable TEMP?

b. Format.

(1) Is there a Scope, Criteria, and Rationale paragraph for each issue?

(2) Does paragraph numbering follow the dendritic format of X.0 - Issue, X.1 - Scope, X.2 - Criteria, and X.3 - Rationale? (X is the issue number, i.e., 1, 2, etc.)

(3) Does each criteria have an associated rationale subparagraph?

(4) Are the mandatory notes and other system peculiar notes included?

c. Content - Issues.

(1) Do the issues reflect only those few key operational concerns and standards for determining the system's readiness at the "Beyond LRIP" (MS III) decision review to enter full scale production?

Figure 3-11. Checklist for COIC

(2) Are the issues in the form of questions to be answered "yes" or "no" (i.e., no issue should be investigative in nature - "How well" or "What is")?

(3) Are the issues based on the MNS?

(4) Are the issues operationally realistic and do they ask if/whether a task/function or mission (kill, be sustained, etc.) can be achieved?

(5) Do the issues focus on the total operational system and not its component parts?

(6) Do the issues focus the decision? (They should not over generalize, e.g., "Is system X operationally effective/sustainable in an operational environment.)

(7) Are issue statements free of criteria (i.e., performance standards)?

(8) Has overlapping coverage between issues been avoided to the degree possible and appropriate?

d. Content - Scope.

(1) Does the scope identify the operational capabilities to be examined?

(2) Are terms peculiar to the system and evaluation of each issue defined?

(3) Are the tactical context and scenario(s) applicable to evaluation of each issue identified?

(4) Are key system deployment and organizational structure factors applicable to evaluation identified?

(5) Are applicable approved threat documents referenced?

(6) Are applicable crew and maintainers identified?

(7) Are key natural and battlefield environments identified?

(8) Have requirements for technical testing and modeling analysis been identified?

Figure 3-11. Checklist for COIC Continued

(9) Is the scope free of criteria and requirements statements (e.g., must do something)?

(10) Is the scope free of requirements for statistical confidence levels applicable to the criteria?

e. Content - Criteria.

(1) Is there at least one criteria for each critical operational issue?

(2) Is each criteria a "show stopper" for the "Beyond LRIP" (MS III) decision?

(3) Do the criteria represent a performance threshold (e.g., quicker delivery of mission/operational orders [MS I TEMP] or delivery of mission/operational orders within one hour, on the average, after initiation of operations [MS II TEMP]?

(4) Are all criteria based on or derived from requirements documented in the MNS, ROC/ORD, FD, COEA, etc., and do they reflect the critical operational needs and constraints? (The criteria do not have to be a direct lift but must be auditable to an approved source document.)

(5) Do the criteria reflect a level of system maturity appropriate to the milestone TEMP?

(6) Has overlapping coverage among criteria been avoided to preclude multiple failure for a single shortfall?

(7) Are all criteria which are not total system measures (the preference) fully justifiable?

(8) Do criteria reflect only essential operational requirements (not desired capabilities)?

(9) Wherever possible, are higher order measures of performance (e.g., probability of kill, probability of successful communications, etc.) stated rather than those of contributing components (e.g., probabilities for detecting, engaging, hitting, and killing a target; probabilities for connectivity message accuracy, RAM, etc.)?

(10) Do the criteria avoid the use of Force Exchange Ratio (FER), Loss Exchange Ratio (LER), or similar operational effectiveness measures more appropriate for COEA/modeling?

Figure 3-11. Checklist for COIC Continued

(11) Is a baseline comparison used only when a specific performance measure cannot be derived, when directed by higher authority, or to reduce the chance of bias during test and evaluation?

(12) If a baseline comparison is used, and performance improvement is the objective, is an improvement percentage specified?

(13) Are qualitative criteria measurable?

(14) Are all constraint conditions applicable to evaluation of each criteria stated and consistent with the scope (e.g., MOPP-IV, electronic warfare, etc)? (Note: they may also be included in the system peculiar notes.)

(15) Are all definitions applicable to evaluation of each criteria stated and consistent with the scope (e.g., firepower kill, payload, etc.)? (Note: they may also be included in the system peculiar notes.)

(16) Have potential ambiguities which could result in erroneous T&E been avoided?

(17) Are probabilistic criteria used when man-machine interface dependent (e.g., X% of attempts, median time, etc.)?

(18) Is the appropriate level system (i.e., individual system, a team, platoon, etc.) addressed by each criteria? (Criteria must be the lowest level appropriate for the system - an individual system is preferred; an organizational element should be used when the system's primary mission contributes to unit performance or the measure of performance demands a unit, e.g., more operational systems remaining.)

(20) Are all measures of performance critical to the "Beyond LRIP" (MS III) decision covered? (No key criteria should be excluded because the data source was other than operational test or problems collecting needed data were anticipated.)

(21) Are criteria free of confidence levels?

f. Content - Rationale.

(1) Do the rationale statements justify each criteria?

Figure 3-11. Checklist for COIC Continued

(2) Are reasons statedfor selecting the characteristic/capability used?

(3) Are the ORD, MNS (for AIS), and/or other source document paragraph references identified?

(4) Are complete references provided for criteria derived by combining characteristics or capabilities?

(5) Is an audit trail to the COEA provided?

g. Content - Notes.

(1) Are mandatory notes #1 and #2 present?

(2) Have total system criteria been identified in mandatory note #1?

(3) Is mandatory note #3 present for COIC in support of the MS I TEMP?

(4) Are notes peculiar to the system, as referenced in the body of the COIC, provided?

2. COIC Review and Approval - ACAT I/II Materiel, Theater/Tactical MAISRC, OSD T&E Oversight, and Other Systems Requiring Approval by HQDA, DCSOPS-FD.

a. For TRADOC DCSCD approval:

(1) Is the ORD DA approved?

(2) Is the following coordination complete:

(a) Proponent - coordination with the MATDEV and OPTEC OEC?

(b) HQ TRADOC - coordination with the TMEC (TRADOC Reg 15-3), MATDEV, CG OPTEC, and DAMO-FDT A/O?

(3) Have all concurred with the COIC? (If "NO," strong rationale must be provided for TRADOC DCSCD consideration.)

b. For DA ADCSOPS-FD approval:

(1) Are the COIC TRADOC DCSCD approved?

Figure 3-11. Checklist for COIC Continued

(2) Has the CG, OPTEC concurred with the COIC?

(3) If the CG, OPTEC nonconcurred and TRADOC DCSCD disagrees with the nonconcurrence, has a joint CG OPTEC/TRADOC DCSCD/DA ADCSOPS-FD forum been set for resolution?

(4) Has the COIC-ORD cross-walk "Horse Blanket" been prepared for the DA decision briefing?

(5) Have the appropriate DA Staff elements concurred with the COIC?

(6) Has the appropriate ODCSOPS pre-brief been accomplished?

3. COIC Review and Approval - ACAT III/IV Materiel and Theater/Tactical non-MAISRC Systems not on the OSD T&E Oversight List.

a. Is the ORD - TRADOC approved?

b. Has the COIC been coordinated with the MATDEV, OPTEC OEC, CASCOM, and HQ TRADOC TRASSO?

c. Have all concurred with the COIC? (If "NO," strong rationale must be provided for TRADOC Proponent/DCSCD consideration.)

4. COIC Review and Approval - Sustaining Base and Strategic MAISRC Systems.

a. Are the MNS and ORD approved?

b. Has the COIC been coordinated with and concurred in by CG OPTEC, PM, and appropriate DA staff elements?

c. Is FP COIC briefing ready for presentation to VDISC4?

Figure 3-11. Checklist for COIC Continued

COIC DEVELOPMENT SAMPLE

THE SITUATION:

<u>System</u> - Communications system including radio set (component of the user system), and net control station (NCS) with generator, vehicle and crew.

<u>Need</u> - High speed, secure and nonsecure, jam resistant data communications for automated systems.

<u>Mission</u> - Deploy to theater of operations, set up, initialize net, provide continuous communications support, and relocate components (frequently) to survive.

<u>Deployment</u> - Light forces divisions through battalion command posts and key operational units.

<u>Employment</u> -
- Combined and joint operations control
- Division systems control manages net
- NCS support (dedicated team with vehicle)
- Radio set support (standard logistics)

<u>Acquisition Strategy</u> -
- Developmental system (NCS and radio set)
- Uses standard truck, shelter, and generator
- ORD and Milestone II approaches approved
- MS IIIA (LRIP based on technical and user tests)
- MS III (full production based on technical and IOT)

<u>ORD Requirements Emphasis</u> -
- Connectivity between users (communications link exists)
- Continuity of operations during movement and maintenance
- NCS set up, tear down, and net initialization times
- Aerial deployment for NCS (radio certified with user)
- Allied and combined operations interoperability
- RAM for NCS and radio set

<u>ORD Requirements</u> -
1 User connectivity 90% of the time in a benign environment
2 User connectivity 80% of the time in an EW environment
3 User throughput (messages/hour) identified by the user

Figure 3-12. COIC Development Sample

4 User speed of service requirement identified by the user (not more than a factor of 3 degradation in an EW environmentfor priority messages)

5 Continuity of net operations (NCS/radios) during movement and maintenance

6 NCS roll-on/off transportability via C-130

7 NCS certified for air drop and Low Altitude Parachute Extraction System (LAPES) deployment

8 NCS set up (first radio in net) within 45 minutes

9 NCS tear down and depart site within 45 minutes

10 High Altitude Electromagnetic Pulse (HAEMP) and Nuclear, Biological and Chemical Contamination (NBCC) survivable

11 Employed in hot, basic, and cold climates

12 Communications interface with allied and other service communications systems used with automated control systems

13 School NCS training will include training device (one trainer station and four (4) student stations); unit sustainment training will be supported by an exportable training package

14 Reliability, Availability, and Maintainability (RAM): NCS A_o .9, Mean Time Between Operational Mission Failure (MTBOMF) 300HR, and Maintenance Ratio (MR) 0.002; Radio Set A_o .95, MTBOMF 300HR, and MR 0.0005

Specification Requirement - 90% throughput success and 90% speed of service success, given user connectivity exists

Operational Mode Summary/Mission Profile (OMS/MP) - NCS set up within 45 minutes, operate for 2 hours, tear down within 45 minutes, movement 1 hour, 24 hour/day operations; Radio Set IAW user system OMS/MP

Approved COI for Another Communications System -

- Three Issues -- Does/Can it
  - -- Provide secure voice and data communications meeting user need
  - -- Deploy from garrison to field and operate IAW OMS/MP
  - -- System with logistics sustain combat operations
- Key criteria --
  - -- Probability of a message being sent and received in benign and Electronic Warfare (EW) environments
  - -- Movement to field site in a single lift
  - -- Set up and tear down times
  - -- Sustained combat operations for 30 days

Figure 3-12. COIC Development Sample Continued

<u>Other Considerations</u> -

- Technical test to verify technical characteristics
- DIA approved threat package and scenario to be used in Initial Operational Test (IOT)
- IOT to test total operational system
- Doctrine and Organization Test Support Package (TSP) to be used for employment in IOT
- COIC Guidance - sustainment COIC for a control system should address training maintaining proficiency in the unit and logistics sustaining combat operations for a period of time
- Approved COIC for Another System Included:

Figure 3-12. COIC Development Sample Continued

COIC Development Sample Continued

A SOLUTION:

Critical Operational Issues and Criteria (COIC)
for the AN/GRC-986(V) Communications System
for Test and Evaluation Master Plan (TEMP) Supporting
Milestone II

1.0 Issue: Does the AN/GRC-986(V) system provide high speed, secure and nonsecure, jam resistant data communications for light forces automated control systems?

1.1 Scope: This issue examines the capability of the AN/GRC-986(V) to provide high speed, secure and nonsecure, jam resistant communications support for light forces, to include combined and joint operations. A division slice will be played with radios for allies and other services control systems in a net. Communications measure of performance to be examined will be percentage of message traffic passed. The AN/GRC-986(V) will be operated and maintained by qualified soldiers in accordance with the Operational Mode Summary/Mission Profile (OMS/MP). Continuity of operations during movement and maintenance will occur as a normal part of operations. Employment will be in accordance with the Doctrinal and Organizational Test Support Package (TSP). MOPP IV level operations will be simulated.

1.2 Criteria.

1.2.1 The AN/GRC-986(V) will pass at least 73% of the user required priority message traffic to the correct addressee within the user specified speed of service (SOS) (see note 3) in a benign and at least 65% or priority messages with no more than a factor of 3 degradation in SOS in a threat EW environment.

1.2.2 Given compatible automated control systems, the AN/GRC-986(V) will interface with allied and other service systems (see note 4 for systems) to exchange data.

1.3 Rationale. The AN/GRC-986(V) mission effectiveness is its capability to deliver information to the correct addressee in time to take necessary action. During combined and joint operations, other services or allies are part of the mission and all must exchange required data.

Figure 3-12. COIC Development Sample Continued

1.3.1 Criterion 1.2.1 was derived from ORD requirements paragraphs 1, 2, 3, and 4 (connectivity in benign and EW environments, throughput, and SOS) and specification requirements for 90% throughput and 90% SOS. Benign percentage = .9 X .9 X .9 X 100 = 73%. EW percentage = .8 X .9 X .9 X 100 = .65.

1.3.2 Criterion 1.2.2 comes from ORD requirement paragraph 12.

2.0 Issue: Can the AN/GRC-986(V) be deployed from garrison to a field site and operate in accordance with the OMS/MP?

2.1 Scope: This issue examines the deployability of the AN/GRC-986(V) as a total system, i.e., shelter/truck mounted radio set and NCS with organic generator. Specific modes/techniques of deployability addressed will be roll-on/roll-off and aerial delivery via Low Velocity Air Drop (LVAD) and LAPES from C-130 aircraft. The crew will be deployed by separate aircraft. Additionally, data will be collected in benign and NBC (MOPP IV) environments on the time required to prepare the system (set up) for operation following crew/equipment link-up and/or arrival at the operations site, and to prepare the system (tear down) for survivability moves.

2.2 Criteria:

2.2.1 The AN/GRC-986(V) net control station (NCS) must be certified for the following transport and deployment methods:

a. Roll-on and roll-off transport by C-130.

b. LVAD (air drop) and LAPES delivery.

2.2.2 The NCS crew must set up and have the first radio in the net within 45 minutes 90% of the time (time starts upon arrival on site). When dressed in MOPP IV, 60 minutes is allowed.

2.2.3 The NCS crew will tear down and depart site with median time less than 45 minutes after receipt of the move order. A median time of 60 minutes is allowed when dressed in MOPP IV.

2.3 Rationale: While the AN/GRC-986(V) NCS will be transported via all modes, aerial deployability is most critical to light units. The NCS must be like deployable to the users it supports. The NCS must move to survive during combat.

Figure 3-12. COIC Development Sample Continued

2.3.1 Criterion 2.2.1 is derived from ORD paragraphs 6 and 7.

2.3.2 Criterion 2.2.2 comes from ORD requirement paragraph 8. Applying a 90 percent factor recognizes the possibility of shortfalls under operational conditions. Set up is considered more time sensitive than tear down. An allowance of 15 additional minutes is made for MOPP IV degradation.

2.3.3 Criterion 2.2.3 is based on ORD requirement paragraph 9, with similar considerations to those for criteria 2.2.2. Median time is considered realistic for tear down.

3.0 Issue: Can AN/GRC-986(V) equipped units achieve training proficiency in garrison and provide a wartime readiness capability for sustained combat operations?

3.1 Scope:

3.1.1 This issue examines sustainment training provided to NCS crews. The unit training device, training publications and literature, and methods of instruction included in the program of instruction will be addressed. Training adequacy will be examined in terms of operator proficiency in performing critical tasks required to effectively employ the AN/GRC-986(V) (the critical tasks and standards to be met will be identified in the training TSP). Questionnaires and structured interviews with the test participants, instructors, and test directorate personnel regarding the adequacy of training, the training device, training materials, and operator acceptability of training manuals in accordance with AR 310-3 will be conducted. Also addressed will be correctness, applicability, format, degree of detail, and ease of use of publications.

3.1.2 This issue also encompasses an evaluation of the maintenance concept, system support package (SSP), and PLL/ASL under operational conditions. To be examined are the dedicated NCS maintenance team, and logistics support hardware and software needed to support the system. Hardware includes tools and test equipment. Software includes technical manuals, repair parts and special tools listings, the maintenance allocation chart (MAC), and parts allocation tables. Operational conditions will include movement to enhance survivability.

Figure 3-12. COIC Development Sample Continued

3.2 Criteria:

3.2.1 The AN/GRC-986(V) NCS crews will be able to practice and perform crew drills in garrison. 95% of the representative soldiers must be capable of performing all critical tasks, for their respective MOS, to the assigned training standard.

3.2.2 The dedicated NCS maintenance teams (1 per NCS), with allotted tools, test equipment, and repair parts, will sustain a division operation for a period of 30 days without negative impact on continuity of operations.

3.3 Rationale: Units will come to combat "as is;" therefore, they must maintain proficiency during peacetime and be capable of sustaining operations until the logistics system catches up.

3.3.1 Criterion 3.2.1 is based on ORD requirement paragraph 13, which plans for an exportable packet for sustainment training.

3.3.2 Criterion 3.2.2 is based on ORD requirement paragraph 14 and the support concept of providing a dedicated maintenance teams for the NCS. The 30 day sustainment factor is minimum essential to allow the logistics system to catch up.

Note 1: Criteria are total system measures. As such, they inherently cover hardware, software, personnel, doctrine, organization, and training. System individual characteristics of operational capability, survivability, RAM, organization, doctrine, tactics, logistics support, training, and MANPRINT (which includes the domains of manpower, personnel, training, human factors engineering, system safety, and health hazards) related to these criteria will be provided by the operational independent evaluator in the operational test and evaluation plan.

Note 2: Criteria are not provided as automatic (default) pass/fail measures. Rather, they represent estimates of performance for which a breach would require a careful senior level management reassessment of cost effectiveness and program options during the program milestone decision review.

Figure 3-12. COIC Development Sample Continued

Note 3: This note would contain a definition of user specified speed of service (SOS).

Note 4: This note would contain a listing of Allied and other service systems with which the AN/GRC-986(V) is required to be interoperable for data exchange.

Figure 3-12. COIC Development Sample Continued

DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART FOUR

DEVELOPMENTAL TEST AND EVALUATION GUIDELINES

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Part Four
Developmental Test and Evaluation Guidelines

Chapter 1
Developmental Test & Evaluation in the Acquisition Process

Section I
General

1-1. Developmental Test and Evaluation (DT&E)
DT&E is conducted throughout the acquisition process to assist in the engineering design and development of a system and to verify that developmental performance specifications have been met.

a. Developmental testing is a generic term encompassing engineering-type testing, generally requiring instrumentation and measurements, which is accomplished by engineers, technicians, and/or soldier operator-maintainer test personnel. It includes technical feasibility testing, engineering development testing, software development testing, production and post-production testing, post-deployment software support testing, and testing associated with vulnerability/lethality assessments.

b. Developmental tests are designed to subject the system or its components, both hardware and software, to stress levels commen- surate with those to which the mature system will be subjected in all operating environments. If required, developmental tests may subject the system to stress levels which will estimate the outer limits of the operational envelope. Developmental testing determines the system safety, technical performance, MANPRINT, human factors performance, and the integrity of the equipment. All government developmental testing and associated production testing on materiel systems are executed by U.S. Army Test and Evaluation Command (TECOM) unless otherwise designated in the Test and Evaluation Master Plan (TEMP). Developmental testing of information systems is conducted at U.S. Army Information Systems Command (ISC) facilities or at TECOM facilities, and the responsibility for developmental testing of strategic defense systems is U.S. Army Strategic Defense Command (SDC). Section XXII, Chapter 3, contains procedures for requesting test and test support services from TECOM.

c. When programs experience technical or operational problems, developmental testing and evaluation provides a valuable service

by helping to find problems and verify fixes before they become show-stoppers. A concerted effort is required by the tester and developer to mature the equipment technically and properly test it before transitioning it for operational testing or production processes.

1-2. Developmental Independent Evaluation/Assessment
The developmental independent evaluator/assessor assists in the engineering design and development and, through the continuous evaluation process, determines the degree to which the technical parameters of the system have been achieved. The evaluator/assessor optimizes the use of data obtained from models, simulations, and test beds, as well as tests conducted on prototypes or full-scale development models of the system. The developmental independent evaluator is U.S. Army Materiel Systems Analysis Activity (AMSAA) for major materiel systems, and TECOM is the developmental assessor for nonmajor materiel systems. Also, SDC has responsibility for the developmental independent evaluation of special SDC programs, and the ISC is responsible for developmental evaluation of assigned information systems.

Section II
Major DT&E Actions during the Acquisition Cycle: Materiel Systems

1-3. DT&E Planning

a. The materiel developer, in coordination with Test Integration Working Group (TIWG) members, structures T&E programs concurrently with the acquisition strategy. Consideration must be given to T&E over the system's entire life cycle. Program planning documents (Section XXII) are a source of information to assist the materiel developer and the developmental tester to identify future test resource requirements (e.g., personnel, funds, facilities, instrumentation).

b. DT&E sufficient to address the critical technical parameters must be done before each major decision point to reduce acquisition risks and to estimate the capability of the system to meet the technical requirements. Developmental test programs will be structured to provide sufficient data to allow evaluation of issues regarding, but not limited to, effectiveness, safety, performance, RAM, and MANPRINT considerations. The developmental independent evaluators/assessors provide the milestone decision authority with information that addresses the critical technical parameters

specifying those which have been designated as exit criteria. Exit criteria are the specific minimum requirements that must be satisfactorily demonstrated before the program can progress into the next acquisition phase (DODI 5000.2, Part 11, Section A).

c. Developmental testing is planned and conducted to take full advantage of the existing investment in DOD ranges and other test facilities, whenever practical. Agencies with requirements for developmental, production, or post-production testing of military materiel use DOD Major Range and Test Facility Base (MRTFB) activities and other DA test facilities instead of establishing in-house capabilities or contracting for testing services. Exceptions are justified in the TEMP.

(1) The DA MRTFB is an aggregation of test activities, facilities, ranges, and equipment designed to provide the Army with the best overall military T&E capability. The MRTFB is operated and managed under uniform reimbursement policy. DOD test customers utilizing the MRTFB are required to pay only those costs that are directly identified to the test. The indirect or overhead costs are funded by the MRTFB activity's parent command (see AR 70-69 and DODD 3200.11).

(2) The MRTFB and other test facilities are capital investments designed to provide comprehensive testing capabilities that support all materiel acquisition programs. These facilities have unique capabilities and expertise and offer significant cost benefits to DA test customers.

(3) DA MRTFB activities are: Yuma Proving Ground, Dugway Proving Ground, U.S. Army Combat Systems Test Activity (located at Aberdeen Proving Ground), White Sands Missile Range, U.S. Army Electronic Proving Ground (located at Fort Huachuca), and Kwajalein Atoll. Section XXI, Chapter 3, contains a brief description of the DA test capabilities, including MRTFB activities. DOD 3200.11-D provides a summary of capabilities of the DOD MRTFB.

d. As requirements are being generated, close interaction is maintained with ongoing technology development programs to ensure focus on critical military needs. Prior to establishment of a program office or approval of a TEMP, Research Efforts/Tests, including Advanced Technology Transition Demonstrations (ATTD) and Proof of Principle (POP) demonstrations, may be used to examine the feasibility of alternative technologies and to expedite technology transition from the laboratory to operational use.

1-4. Concept Exploration and Definition (Phase 0)
Milestone (MS) 0 approves the conduct of concept studies to examine potential solutions in response to an identified mission need and begins Phase 0. During this phase, the Acquisition Strategy is developed, the Operational Requirements Document (ORD) is written for each concept being studied, a TIWG is formed, and a draft TEMP is developed. The developmental tester and the developmental evaluator/ assessor, as members of the TIWG, provide input to the TEMP (see Part Two, TEMP Guidelines).

a. As the ORD and the TEMP are being staffed, the developmental independent evaluator/assessor begins preparation of the Independent Evaluation/Assessment Plan (IEP/IAP). The IEP/IAP is coordinated with the TIWG members.

b. As issues identified in the IEP/IAP are analyzed and satisfied during the continuous evaluation effort, they are retained and annotated in the IEP/IAP, but are not included in future evaluation efforts unless program changes indicate the issue should be reevaluated. Those requiring more evaluation are addressed in follow-on evaluation actions in subsequent acquisition phases. New evaluation issues are added, as appropriate, and data source matrices and test documents are revised accordingly.

c. Technical feasibility tests (TFT) are conducted to explore materiel concepts and refine evaluation issues. The hardware configuration will generally be breadboards, components, subsystems, brassboards, and/or experimental prototypes. TFTs assist in determining safety and establishing system performance specifications and feasibility.

d. The first iteration of the TEMP is approved at MS I, which initiates the development program and approves proceeding into the demonstration and validation phase.

1-5. Demonstration/Validation Phase (Phase I)
During this phase, the TIWG updates the Acquisition Strategy, develops integrated plans for T&E, and the TEMP is updated, coordinated, and approved by the decision authority at MS II. Once the TEMP is approved, deletion of tests requires a waiver by the TEMP approval authority.

a. The developmental independent evaluator/assessor, as a member of the TIWG, integrates evaluation requirements. To optimize evaluation, both contractor and government data are shared by the user, developer, and independent evaluator/assessor. The materiel developer is responsible for providing all data to the independent developmental

evaluator/assessor.

b. The TIWG members assist in the development of the Integrated Test Program Schedule (ITPS) which identifies the type of tests to be conducted and the number, scope, and schedule of test activities for the system throughout its acquisition process.

c. Testing, modeling, and simulations are conducted as planned in the TEMP. Engineering Development Tests (EDT) are conducted during this phase to provide data on safety, the achievability of critical technical parameters, refinement and ruggedization of hardware configurations, and determination of technical risks. The EDT provides data on the compatibility and inter- operability with existing or planned equipment and systems and the system effects caused by natural and induced environmental conditions during the development phase.

d. The MS II decision approves the development of the item and initiates Phase II.

1-6. Engineering and Manufacturing Development phase (Phase II)

a. During the phase leading up to the MS III production decision, developmental testing supports the hardware (or system) and associated software design through a test-analyze-fix-test approach performed at the component, subsystem, and system level; identifies the preferred technical approach, including the identification of technical risk and feasible solutions; examines the operational aspects of support requirements and the selected alternative technical approaches; provides preliminary data on the potential operational effectiveness and suitability of candidate systems; supports the materiel improvement process; identifies design risk; establishes contractual compliance including component qualifications; makes preliminary assessment of MANPRINT requirements; provides data for required test readiness reviews; and evaluates the technical parameters. (See Part Seven for details on software T&E of materiel system computer resources.)

b. A Production Proveout Test (PPT) may be conducted, prior to production testing, to determine the most appropriate design alternative. During this phase, Pre-production Qualification Test (PPQT) is conducted to ensure design integrity over the specified operational and environmental range. A Live Fire T&E may be required during this phase on some systems (see Part Six). (See Section XX, Chapter 3, for other developmental tests that may be required.)

c. A favorable MS III decision is a commitment to produce and support the system.

1-7. Production and deployment phase (Phase III)
Developmental testing during this phase verifies that requirements specified in the Technical Data Package and production contracts are met and provides test data for materiel release action. It determines if the production item fulfills the users' requirement. It is the soldier's guarantee that performance and quality have not been lost in the transition from development to production.

a. For items that are to be procured by the Defense Logistics Agency, the Army is responsible for certifying that the production item conforms to the specifications and that performance is not lost in the production process. The data required for this certification are derived from the government Production Qualification Test (PQT) of the first contract.

b. Testing during the production phase of the materiel life cycle is a logical flow-down of pre-MS III tests and includes the testing necessary to verify that requirements specified in technical data packages and production contracts for hardware or software are met. Production testing also provides a baseline for follow-on post production testing. Production Qualification Tests (PQT) and/or First Article Tests (FAT) are conducted to verify the production item meets contract requirements. A Follow-on Production Test (FPT) may be conducted to verify the adequacy of corrective actions indicated by the PQT. Other production testing includes Comparison Tests (CPT) and Quality Conformance Inspections. (See Section XX, Chapter 3, for detailed descriptions of all production tests.)

c. Planning, programming, and budgeting for testing during production will begin early in the development cycle. Funding will be as prescribed in AR 73-1 and AR 37-100. In general, production items are procured with Procurement, Army (PA) funds, and the procurement of repair parts are Operations and Maintenance, Army (OMA) funded; costs of conducting tests are similarly funded.

d. Provisions will be made in the Long-Range Army Materiel Requirements Plan (LRAMRP) for test items, facilities, instrumentation, and resources to support quality assurance testing during production.

e. Criteria for production testing will be prescribed in the appropriate Technical Data Package based upon the performance

demonstrated during development or in the contract performance specifications. Description of the test, methods of analysis, and pass/fail criteria will be included. The number of items to be tested and the duration of tests will be based upon sound engineering practices in consideration of costs, schedules, item complexity, known problem areas, risks (confidence levels), and other factors. Advantage will be taken of prior test data and analytically derived design data in developing the test and sampling plan. Acceptable quality levels (AQLs) will not be used in association with acceptance of materiel from a production contract.

f. The total system is tested during PQT. When individual components and subsystems are tested separately, such testing in itself will not be considered as meeting total system test requirements.

g. Proponent activities will establish procedures to assure the timely planning, testing, reporting and resolution of deficiencies on newly procured materiel, and ensure that developmental test requirements are identified to allow appropriate flexibility regarding tests, such as:

(1) Tailoring of sample sizes to meet specific contract requirements.

(2) Termination during early testing if performance is so poor that retesting will be required regardless of the results of the remaining portion of the tests.

(3) Reduction, elimination, or early termination of certain tests when there is sufficient evidence that requirements have been demonstrated with high confidence.

1-8. Post-production testing
Post-production testing is conducted to assure that materiel which is stored, reworked, repaired, renovated, or rebuilt after initial issue conforms to specified quality, reliability, safety, MANPRINT, and technical and operational performance standards. (Post-production tests types are detailed in Section XX, Chapter 3.)

a. Post-production testing is a follow-on to production testing and includes those surveillance and reconditioning tests required to measure the ability of materiel in the field, in storage, and after maintenance actions (to include repair, rebuild, retrofit, overhaul, and modification) to meet user requirements.

b. After fielding, materiel continues to be tested, to be sure that it is holding up in storage and is fully functional, reliable, and operable. Testing is done under conditions that approximate as closely as possible what would be experienced under actual field conditions.

c. Planning, programming, and budgeting for testing during the post- production phase will begin early in the development cycle. Funding will be as prescribed in AR 37-100. In general, post-production testing, to include materiel and conduct of tests will be OMA funded.

d. Criteria for surveillance testing will be prescribed in the appropriate Bulletins (TBs), Manuals (TMs), Storage Serviceability Standards, and Surveillance Test Program Plans.

e. Criteria for reconditioning testing, including pilot reconditioning tests, initial reconditioning (first article) tests, control (comparison) tests, acceptance tests, total systems tests, and baseline evaluation tests at depot or contractor facilities, will be incorporated in Depot Maintenance Work Requirements (DMWRs), Modification Work Orders (MWOs), TMs, TBs, and contracts.

f. Test criteria will be based on performance demonstrated during development and production. The number of items to be tested and the duration of tests will be based upon sound engineering practices considering schedules, costs, item complexity, known problem areas, risks (confidence levels), system and software changes made, and other factors. Advantage will be taken of prior test data and analytically derived design data in developing the test and sampling plan. Existing test facilities will be used rather than building new government or contractor facilities.

Section III
Major DT&E Actions during the Acquisition Cycle: Information Systems

1-9. Information System Categories
The two categories of Information Systems (theater/tactical and nontheater/tactical) are defined in AR 73-1 (para 3-2).

a. Theater/tactical information systems follow the same phases and milestones as materiel systems.

(1) Developmental testing of information systems includes Software Development Tests, Software Qualification Tests, and Post-Deployment Software Support tests. Software Development Tests are conducted by the developer on programs and modules; qualification tests are conducted during Phase II by the government developmental tester at the system level and include a developmental independent evaluation/assessment; and post-deployment tests consist primarily of modifications and maintenance of software. (Section XX, Chapter 3 defines the software test types that are conducted by the government developmental tester.)

(2) System-level developmental testing is conducted at stress levels representative of data volumes expected to be encountered under the most extreme circumstances (e.g., deployment surge, wartime operation with full force structure participation, and year-end closeout processing). Developmental testing will be structured to estimate the outer limit of the system's operational envelope.

b. Nontheater/tactical information systems follow a slightly different life cycle, in that the phases do not correspond directly to the materiel system life cycle phases. The life cycle phases are compared in Figure 3-1, AR 73-1. All developmental testing of nontheater/tactical informations systems is conducted by the developer in conjunction with the user.

1-10. Software T&E

For more detailed information regarding software T&E, see Part Seven.

Section IV
Nondevelopmental Item T&E

1-11. General

Nondevelopmental items (NDI) provide a preferred alternative if the market surveillance reveals that items are available which have a high probability of meeting the users' requirements. NDI feasibility may surface before preparation of the Mission Need Statement (MNS) or may be identified during the market investigation. This is based upon continuous market surveillance, front-end analysis, responses to Mission Area Analysis deficiencies, and the proposed solution in the Materiel Acquisition Decision Process (MADP). The market investigation becomes much more important as a data source for NDI systems and often is the only source prior to the MS I/III decision review.

T&E requirements to support an NDI acquisition approach do not differ appreciably from the T&E requirements for a developmental program: a TIWG must still be formed; a TEMP is required; test data must be available; and a developmental evaluation/assessment must be performed by the developmental IE.

1-12. NDI Acquisition
The foundation of an acquisition strategy is the market investigation. Prior to the MS I decision, both the developmental and operational evaluator prepare evaluation plans which are used to guide the market investigation. These contain system-specific questions (e.g., performance, MANPRINT, operation, design features) that must be answered during the market investigation process. The answers to these questions will generally require the evaluation/assessment of existing commercially available test data, technical feasibility test results, or user experiment data.

1-13. NDI T&E Master Plan
If the results of the market investigation indicate that an NDI solution is feasible, the TEMP will reflect the test activities, if any, required to do one of the following:

a. Proceed directly to a combined MS I/III decision review which makes the production and type classification decision; or

b. Proceed to an MS I/II decision review. In this instance the requirement for a Preproduction Qualification Test (PPQT) of the NDI candidates will be initiated. This test will be conducted to determine if requirements are fully satisfied. The extent of modifications, if required, is one factor which determines if and how much OT is necessary.

1-14. DT&E for NDI
Developmental testing requirements will be tailored to each specific system. DT&E will be conducted, at a minimum, to verify integration and interoperability with other system elements. Additional T&E, as appropriate, will be conducted to evaluate and control risk. The following is provided as general guidance, not rigid requirements, of the testing activities appropriate for the following NDI options:

a. Off-the-shelf items to be used in the same environment for which they were designed (i.e., no development or modification of hardware or software is required) will normally not require developmental testing before MS I/II or I/III; however, Force Development Tests & Experiments and TFTs may be conducted to support the MS decision. When the contract is awarded to a

contractor who has not previously produced an acceptable finished product and the item is assessed as high risk, a PQT should be required.

b. Those off-the-shelf items which require some modification of hardware or operational software (e.g., militarization or ruggedization) will require TFT, unless the decision authority documents that further testing is not required. PPQT is required if feasibility testing results in the necessity for fixes to the item. Production qualification testing (PQT) is required to support materiel release.

c. An R&D effort is required for NDI items used as subsystems, modules, or components which contribute to a materiel solution. Systems engineering, software modification, and testing is required to ensure the total system meets user requirements and is producible as a system. TFT is required in a military environment. PPQT of the complete system is required. Hardware/ computer software integration tests are required and both PQT and OT are required.

d. Some follow-on testing of the NDI may be required to verify the adequacy of corrective actions indicated by the PQT.

1-15. OT&E for NDI
See Part Five for OT&E requirements for NDI.

Section V
Live Fire T&E

1-16. General
Through a series of amendments to Title 10, United States Code, Congress has mandated that major weapon system and munition programs (see DODI 5000.2, Part 8) undergo a realistic Live Fire Test and Evaluation (LFTE) program. LFTE is part of the developmental testing of the system's vulnerability and lethality. The scope of LFTE should build upon early developmental tests of components and system vulnerability and lethality modeling and should be reflected in the TEMP. See Part Six for detailed information regarding LFTE.

Section VI
Clothing and Individual Equipment DT&E

1-17. General

The acquisition of clothing and individual equipment (CIE) is governed by AR 700-86. The overall philosophy is very similar to the process described in AR 70-1 except that an Army Clothing and Equipment Board and a Clothing Advisory Group recommend items for approval by the Vice Chief of Staff, Army.

1-18. Requirements for DT&E

Testing requirements are outlined in part III of a Statement of Need of the CIE. Upon procurement of a CIE item, government initial production testing should be conducted to certify the specifications so that future procurements and Defense Logistics Agency's quality control are effective. T&E management documents for the acquisition of CIE are the same as those required for the acquisition of ACAT III and ACAT IV systems acquired under the auspices of AR 70-1, i.e., TEMP, IAP, DTP, TR, and IAR.

Section VII
DT&E in Support of Type Classification

1-19. General

Type classification is the process which identifies the degree of acceptability of a materiel item for Army use and provides a guide to authorization, procurement, logistical support, and asset and readiness reporting. See AR 70-1, Chapter 3, for type classification designations and applicability.

1-20. DT&E Requirements

Type classification is an integral part of the MS III decision process. Testing and program documentation requirements are the same for the production decision and the type classification designation. As a minimum, PPQT must be completed before the full-rate production decision. See Part Five for OT&E requirements.

Section VIII
Joint Acquisition Program DT&E

1-21. General

DT&E requirements for acquisition programs being developed jointly by more than one DOD component are the testing procedures of the designated lead service. Program documents are developed by the lead service (see AR 73-1, Chapter 3).

Section IX
Modifications

1-22. General
Modifications, whether a result of Preplanned Product Improvement, Engineering Change Proposals, or Post-Deployment Software Support, may require developmental test and evaluation/assessment. The purpose of testing modifications is to determine the viability and adequacy of the change and to determine if the change was achieved without degradation to the system, other components, and interface equipment. Therefore, the required scope and type of testing/evaluation varies for each modification.

1-23. DT&E Requirements
To determine the required testing/evaluation, the materiel developer, in coordination with the combat developer and the independent evaluators/assessors, determines which of the following procedures will be employed for the conduct of T&E:

a. Through the TIWG process with all T&E documented in the TEMP. This is the same procedure used for a new development program and includes an independent developmental evaluation/assessment, as well as an operational evaluation.

b. Through an abbreviated T&E procedure that does not require a TIWG, a TEMP, or an operational evaluation/endorsement. This procedure may or may not require developmental testing and evaluation. This is determined by the materiel developer, in coordination with the TIWG. The materiel developer consults the coordination checksheet (see Part One) to determine if coordination with the developmental evaluator/assessor is required. If coordination is required, a modification package is provided to the evaluator/assessor for determination of the need to conduct a formal evaluation/assessment and/or requirement to conduct developmental testing. Waiver may occur if the checksheet indicates the coordination is not required or if the developmental evaluator/assessor (after review of the modification data) decides the evaluation/assessment is not needed. In the latter case, formal notification to the materiel developer will be made by the evaluator/ assessor. In both cases, the materiel developer will furnish the independent evaluator/assessor a copy of the completed checksheet for information.

c. A major modification (i.e., a program that meets the criteria of an ACAT I or II or is so designated by the decision

authority) requires a MS IV decision (DODI 5000.2, Part 3).

Section X
Waivers of Approved Testing.

1-24. General
DT&E which is specified in the approved TEMP must be conducted unless a waiver has been obtained from the TEMP approval authority. Procedures for requesting waivers can be found in AR 73-1, Chapter 3.

Chapter 2
Requirements Translation

Section I
Introduction

2-1. General
The proper interpretation of user requirements and the subsequent translation of those requirements to testing issues and parameters is the first step of a test program. Broad operational capability needs are translated into system-specific performance requirements.

Section II
Requirements Documents

2-2. Mission Need Statement (MNS)
The MNS initiates the MS 0 review. It is a statement of operational capability need that is nonsystem specific and states the requirements in broad operational terms. The MNS forms the basis for the Operational Requirements Document.

2-3. Operational Requirement Document (ORD)
The ORD contains objectives and minimum acceptable requirements for performance tailored to each concept. They are generated by the combat developer and coordinated with the materiel developer and the TIWG members.

Section III
Contractor Specifications

2-4. Development of Contractual Documents
The materiel developer generates the contractual documents. The translation of requirements to specifications and then to testing criteria is one of the most difficult transitions in the materiel acquisition process. Because these contractual documents must be legally exacting and enforceable as well as technically complete, they are usually more voluminous and quite different than the corresponding requirements document. The testers and evaluators are involved in the development of these documents (i.e., the RFP and related contractual documents such as the system and development specifications) through the review process. The TIWG must review them to ensure the specifications and standards cited are correct, the proper criteria are reflected, and the requirements are testable.

2-5. Role of Developmental Tester & Evaluator/Assessor
The transition from requirements document to contractual

requirements is a key in developing the testing program. In particular, the government developmental tester and evaluator/assessor must know what requirements are contained in both the ORD and the contract to formulate a testing strategy that takes into consideration the technical requirements and the testing performed prior to acceptance by the government. This review provides the TIWG the opportunity to take maximum advantage of testing resources. This review also facilitates the test data confirmation procedures outlined in Section ???, Chapter 4.

2-6. Confirmation of the Translation Process
When the contractor receives the contractual document containing these requirements, there is another translation process. This is the actual fabrication of an end product intended to meet not only the technically exacting specifications of the contract, but also the program baseline requirements. Government developmental testing provides the materiel developer, the developmental evaluator/assessor, and the decision maker with information on the contractor's success at meeting the performance standards and establishes the safety parameters for operational testing. In a technical sense, it is a feedback loop that measures what was produced by the contractor against what was intended by the contract. It is important because it allows the materiel developer to iterate and refine the product when problems are revealed. It also confirms that the product produced is acceptable.

Section IV
Critical System Characteristics

2-7. General
The ORD identifies the Critical System Characteristics with proposed thresholds and objectives. Critical System Characteristics are those design features that determine how well the proposed concept will function in its intended operational environment. They include survivability; transportability; electronic counter-countermeasures; energy efficiency; and interoperability, standardization, and compatibility (DODI 5000.2, Part 4, Section C). Selected Critical System Characteristics are included in the TEMP as Critical Technical Parameters.

Section V
Critical Technical Parameters

2-8. General
Critical technical parameters (CTP) are developed jointly by the

independent evaluator/assessor, the materiel developer, and the combat developer, with input from the TIWG members, if required. The CTPs are listed in matrix format in Part I of the TEMP (DOD 5000.2-M, Part 7, Figure 1).

2-9. Function of CTPs
Each CTP has measurable objectives and thresholds to be evaluated, and they are derived from the ORD, the critical system characteristics (including software maturity and performance measures), and the technical performance measures. CTPs establish a relationship between the operational requirements and the developmental testing to be performed during each acquisition phase. CTPs are evaluated using data obtained through testing, surveys, studies, modeling and simulation, or other analytical means.

a. Part III of the TEMP includes the specific critical technical parameters which the milestone decision authority has designated as exit criteria and which must be confirmed in each phase of testing. The CTPs must take into consideration the COIC to ensure a smooth transition from DT&E to IOTE.

b. The following areas will be considered critical, as appropriate: system performance, physical attributes; reliability, availability, and maintainability; system safety; transportability; health hazards; natural environmental or climatic effects; logistic supportability; software; compatibility and interoperability; survivability, including conventional ballistic vulnerability; nuclear hardness and survivability; electromagnetic environmental effects; directed energy vulnerability; chemical, biological, radiological vulnerability; electronic warfare, countermeasures and counter-countermeasures; training; and vulnerability and lethality.

2-10. Noncritical technical parameters
Noncritical technical parameters may be required by the developmental evaluator/assessor for completeness or by regulatory guidance (such as generic military specifications). Noncritical parameters may become critical as the system evolves. Noncritical technical parameters are documented in the IEP/IAPs.

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Chapter 3
Developmental Testing and Evaluation

Section I
Role of the Developmental Tester

3-1. Contract Requirements
Procurement policies define testing as that element of inspection which determines the properties or elements, including functional operation of supplies or their components, by the application of established principles and procedures. Inspection is defined as "examining and testing supplies or services (including, when appropriate, raw materials, components, and intermediate assemblies) to determine whether they conform to contract requirements."

3-2. Review of Requirements
The contracting officer or his/her representative has responsibility for all contractual matters. However, the materiel developer should rely on the developmental tester for assistance in ascertaining that the technical aspects of the system, as described in the contractual document, are properly tested. For this reason, the materiel developer has the government developmental tester review the requirements and testing portions of both the solicitation and the contractual documents. Since the contract designates when and where the Government reserves the right to determine that the technical requirements in the contract are met, the government developmental tester provides input to the materiel developer prior to issuance of the solicitation document. This review centers on the requirements relating to the quality of the product and those quality controls incumbent on the contractor to ensure that the product conforms to contractual requirements.

3-3. Quality Requirements
Because of the complexity of Army acquisitions and their critical application (in which failure could injure personnel or jeopardize a vital mission), quality requirements contained in contractual documentation should be tested by the Government developmental tester.

3-4. Source Selection Evaluation Board (SSEB)
The Government developmental tester should a be an advisor to and may, if appropriate, participate in SSEB deliberations. In this way, testing programs can be structured to optimize the acquisition approach.

3-5. Cost Estimates

When a government contract which includes testing at a Government facility already exists, the request for cost estimate, the test request, and the test funding must be provided through the contracting government agency directly to the Government tester rather than by the contractor. If a prospective contractor is preparing to bid on a government contract which requires testing, a cost estimate for testing by the government provided to that contractor is inappropriate. This would constitute privileged information pertaining to the solicitation. Such estimates are obtained and distributed to all bidders by the contracting agency.

3-6. Private Industry Testing

Test services may be provided by TECOM for private industry when no related acquisition contract exists. The guidance and procedures for this can be obtained by contacting Commander, TECOM, ATTN: AMSTE-TA-O, Aberdeen Proving Ground, MD 21005-5055.

Section II
Developmental Evaluation/Assessment

3-7. Continuous Evaluation

A continuous evaluation process is used on all acquisition programs (see Part One). It emphasizes the role of independent evaluation/assessments throughout the acquisition process to ensure responsible, timely, and effective evaluations/assessments of the status of a system as it progresses into mature system effectiveness and suitability. Early involvement of the evaluators/assessors in the acquisition process is vital to a successful developmental program.

3-8. Developmental Evaluation/Assessment Responsibilities

All acquisition categories are either independently evaluated or independently assessed (see AR 73-1, paragraph 4-8). At program initiation (MS I), a decision is made as to whether the program will be evaluated or assessed based on the following criteria:

a. AMSAA will perform developmental independent evaluations of ACAT I, ACAT II, and other programs as designated by ASA(RDA), and associated product improvements, TMDE, ammunition, system specific support items, and training devices.

b. TECOM will perform independent developmental assessments of other systems (ACATs III and IV) and associated product

improvements, TMDE, ammunition, system specific support items, and training devices.

c. Once assigned to either AMSAA or TECOM, the responsibility for assessment or evaluation remains with that organization throughout the life cycle, unless reassigned by HQ AMC or HQDA.

d. For ACAT III and IV programs, when the technology or mission of the system is so similar to that of an ACAT I, ACAT II, or another ASA(RDA)- designated system as to warrant evaluation, it may be determined that the system will be evaluated by AMSAA.

e. For those ACAT III and IV systems, when the level of technology or the requirements for modeling and simulation indicate that an evaluation would be appropriate, the decision may be made that an evaluation will be performed by AMSAA.

3-9. Basis for Evaluation/Assessment
The developmental independent evaluation/assessment is based on test data, reports, studies, and other appropriate sources, and is the culmination of a major effort by many people. The evaluation/assessment compares the performance of the item, as derived from the test data, directly with the requirements reflected in the ORD and the Critical Technical Parameters contained in the TEMP. The independent evaluator/assessor also compares the test results to the required operational performance according to the mission profile, the Cost & Operational Effectiveness Analysis (COEA), and to any past results, and addresses the "so what" questions concerning requirements.

3-10. Procedures/Techniques for Evaluation/Assessment
Through the IEP/IAP or the TDP, the evaluators/assessors identify the procedures and techniques which will be used in the evaluation. For example,

a. Specific models will be identified, e.g., reliability growth, performance, logistics. (See Chapter 16, Part One.)

b. Method of statistical analysis (inferential techniques) are identified, such as hypothesis testing and analysis of variance.

c. Comparison of results to the requirements may be accomplished through quantitative comparison or subjective/qualitative comparison.

d. Measures of effectiveness are developed, e.g., system

effectiveness (E_{SO}), fractional target damage, probability of a kill given a hit, probability of a hit, probability of detection.

Section III
Role of the Developmental Independent Evaluator/Assessor

3-11. General
The evaluators/assessors contribute to the acquisition and fielding of an effective, supportable, and safe system by assisting in the engineering design and development and verifying attainment of technical performance specifications, objectives, producibility, adequacy of the Data Package, supportability, RAM and MANPRINT aspects. Developmental evaluation encompasses data obtained from the use of models, simulations, and test beds, as well as prototypes or full-scale development models of the system.

3-12. Reporting Evaluations/Assessments
For each milestone decision review and the materiel release decision, the developmental evaluator/assessor prepares an IER/IAR. Coordination of information contained in the IER/IAR between the testers and evaluators is important to ensure that test data are accurately reflected. The IER\IAR highlights those technical parameters that have been evaluated and require no additional analysis. They also present those that need further evaluation to support MS decisions, as well as materiel release actions.

3-13. Mission of Evaluators/Assessors
The developmental independent evaluators/assessors serve on the following working groups, committees, or teams, if formed: Special Task Force, Special Study Groups (AR 71-9), TIWGs, TRRs, RAM scoring conferences and RAM assessment conferences, MANPRINT Joint Working Group, System Safety Working Group, market survey teams, and ILSMTs. Developmental independent evaluators/assessors normally brief the IER/IAR at pre-ASARCs and IPRs for materiel systems and at pre-MAISRCs for information systems. Developmental IER/IARs as well as the operational IER are briefed by the operational IE at the ASARCs and the MAISRCs. Specific actions to be performed or participated in by the developmental IE are --

a. Review and be knowledgeable of applicable MAA results.

b. Review requirements documents, System Program Issues,

critical issues, and the System Threat Assessment Report (STAR).

c. Provide information to, and draw information from, the TIR data base (see Capstone Volume).

d. Review system support packages.

e. Develop technical parameters and process for approval as appropriate.

f. Participate in the development of system acquisition strategies, and assist in the development of test portions of selected Requests for Proposal (RFP).

g. Within the TIWG, develop procedures to accept data gathered from all sources.

h. Perform developmental test integration as a member of the TIWG, assist in the development of, and provide concurrence in, the TEMP, and chair the LFTE Working Group, if required.

i. Review and comment on test plans.

j. Respond to questions and provide input in terms of performance analysis during the development of the COEA, cost and training effectiveness analysis (CTEA), and other cost analyses.

k. Review and comment on the System MANPRINT Management Plan and the ILS Plan.

l. Develop IEP/IAPs, Test Design Plans (TDPs), and IER/IARs.

m. Review and provide concurrence in the RAM Rationale Report.

n. Determine and coordinate modeling and simulation needs and use their results.

o. Monitor tests in coordination with the developmental tester.

p. Recommend approval/disapproval of requests for waiver of approved tests and recommend test suspensions when required.

q. Evaluate Test Incident Reports (TIR) and corresponding corrective actions.

r. Advise in source selection activities, as required by the

materiel developer.

s. Present results of Developmental IER/IAR at Operational Test Readiness Reviews (OTRR), as appropriate.

The developmental IE/IAs continue involvement throughout the system life cycle by monitoring key deployment activities. This is accomplished by partici- pation in system performance reviews; fielded equipment reviews (e.g., Fielded System Review); research, development, and acquisition (RDA) reviews; and sample data collection. It is also accomplished by monitoring stockpile reliability and lot acceptance tests.

Section IV
Role of System Contractor in Support of Developmental Testing

3-14. General

The objectives of developmental testing and evaluation include verifying system maturity, logistic supportability, human factors, and system safety. One of the primary objectives is to verify reliability, availability, maintainability-durability (RAM-D) maturity. Therefore, testing is designed to find, analyze, and fix problems and verify the solutions. Meeting these objectives requires engineering level involvement of, and discussions with, system contractor personnel.

3-15. Nature of Contractor Involvement

The degree and nature of system contractor involvement in the developmental testing must be agreed to by the developer, the evaluator, the government tester, and all others concerned, preferably through the TIWG. Those agreements must then be communicated through contractual requirements. Developing these agreements early will help to ensure that test data will be usable for evaluation purposes. (See Section XII, Test Data Confirmation.)

a. Contractor involvement may range from no direct involvement to providing spare parts and technical advice during the conduct of the test, to performing entire tests. When the contractor will be directly involved in the conduct of testing at a government facility, special consideration may be required to address security, personnel safety, and the protection of competition sensitive test data. When the contractor will perform the testing, consideration should be given to the use of a combined government/contractor developmental test team. Use of the team provides for government participation in the development

of the contractor test plans. The test results are reported by the contractor and verified by the government test personnel, thus avoiding duplication of testing.

b. The degree of contractor involvement in scoring/assessment conferences dealing exclusively with developmental test and evaluation will, likewise, be determined by the materiel developer in coordination with the TIWG. Contractor personnel, in general, should not be physically present during the formal voting/scoring/ assessment period. However, the presence of contractor personnel may be allowed during formal scoring at developmental scoring conferences if it is considered necessary for proper information flow, except as discussed in the following paragraph.

c. In those cases where it is known that the developmental test will be conducted under conditions similar (operational mode summary/mission profile, stresses, environmental conditions, test support, fixed and same configuration) to IOT&E, and IOT&E is to be conducted during the same phase, OPTEC will notify AMC that the developmental test results are to be combined with the IOT&E results. If agreed to by the materiel developer, system contractor participation in the scoring and RAM assessment conferences addressing developmental test data will be the same as for IOT&E conferences. (Reference Part One, Chapter 11.)

Section V
Developmental Test Types

3-16. General
Developmental tests are categorized as reflected in AR 73-1, Chapter 4. A definition and brief description of the developmental tests performed throughout the acquisition cycle follows. The tests are separated into the pre-MS III, production, and post-production phases. The software tests defined here are Software Qualification Test (SQT) and Post Deployment Software Support (PDSS). For other developmental tests conducted by the developer of the software, see Part Seven.

3-17. Pre-MS III Developmental Test Types
Pre-MS III developmental testing ranges from program initiation to the MS III production decision and includes funding categories 6.1-6.4.

a. Research Effort/Test. Developmental effort/test conducted prior to MS 0 to determine early technical parameters, to support

the research of these items, and to provide fundamental knowledge for solutions of identified military problems. Program funding category - 6.1 and 6.2.

b. Technical Feasibility Test (TFT). DT conducted post-MS 0, pre-MS I or MS I/II to assist in determining safety, establishing system performance specifications, and determining feasibility of alternative concepts. Testing during the Concept Exploration and Definition Phase identifies and reduces risks in subsequent acquisition phases. This test provides data for the independent developmental evaluation/assessment which supports the MS I or MS I/II decision. Program funding category - 6.3. NOTE: While not tied to specific acquisition programs, the following Technology Base demonstrations may be conducted by the Government developmental tester. Technology demonstrations are conducted to assess the military utility or cost reduction potential of innovative Government or commercially developed technology (DODI 5000.2, Part 5-C).

(1) Advanced Technology Transition Demonstration (ATTD). ATTDs are used to expedite technology transition from the laboratory to operational use. They are demonstrations conducted in an operational environment and are primarily funded with 6.3A funds. These demonstrations may integrate advanced technologies to establish the feasibility of a concept or may utilize prototypes, surrogates, and simulations to show that existing technology can support a concept. ATTDs should include provisions for early testability and operational assessments.

(2) Proof of Principle (POP) demonstrates, in a nonoperational environment, innovative technologies that will support system upgrades or provide new operational capabilities. POPs are technical demonstrations and troop experimentations conducted with brassboard configurations, subsystems, or surrogate systems.

c. Engineering Development Test (EDT). DT conducted post-MS I, pre-MS II to demonstrate attainability of critical technologies and processes and to define design characteristics and capabilities, including ruggedness of hardware configurations, compatibility and interoperability with existing or planned systems, and the effects of natural and induced environmental conditions. This test provides data for the independent developmental evaluation/ assessment which supports the MS II decision. Program funding category - 6.3.

d. Production Proveout Test (PPT). A DT conducted with prototype hardware post-MS II or post-MS I/II, prior to MS III to

select the most appropriate source or design. When MS I and MS II are combined, PPT may also be used to provide data on safety, the achievability of critical system technical parameters, refinement and ruggedization of hardware and software configurations, and determination of technical risks. Program funding category - 6.4.

e. Preproduction Qualification Test (PPQT). A system level DT conducted post-MS II or post-MS I/II (usually just prior to MS III) that demonstrates design integrity over the specified operational and environmental range. These tests usually use prototype or preproduction hardware and software fabricated to the proposed production design specifications and drawings. Such tests include contractual reliability and maintainability demonstration tests required prior to production release. This test provides data for the independent developmental evaluation/assessment which supports the MS III production decision. Program funding category - 6.4.

(1) The objectives of the PPQT are to have the government confirm the design is stable, logistically supportable, capable of being produced efficiently and will meet the performance/user requirements, assess the performance envelope, and determine the adequacy of any corrective action indicated by previous tests.

(2) PPQT may also include tests which are not included in the data package or contract (example: environmental extremes, test-to-failure) when necessary to obtain engineering data for corrective action verification or other purposes. PPQT may be accomplished in phases (e.g., preliminary engineering, specific problem correction, etc.).

(3) For those weapons systems required by law to undergo live fire test and evaluation (see volume 5), the live fire test (LFT) is conducted as part of or in conjunction with the PPQT. The LFT demonstrates the ability of the system to provide battle resilient survivability, or the munition to provide lethality. It will provide insights into the principal damage mechanisms and failure modes occurring as a result of the munition/target interaction and into techniques for reducing personnel casualties or enhancing system survivability/lethality. LFT is conducted with 6.4 or procurement funding.

f. Logistic Demonstration (LD). An LD is a nondestructive disassembly and reassembly of equipment conducted on a dedicated engineering prototype prior to MS III to evaluate the supportability of the materiel design and the preliminary system support package. It evaluates the achievement of maintainability

goals; the adequacy and sustainability of tool, test equipment, technical publications, maintenance instructions, and personnel skill requirements; the selection and allocation of spare parts, tools, test equipment, and tasks to appropriate maintenance levels; and the adequacy of maintenance time standards. Program funding category - 6.4.

g. Software Qualification Test (SQT). The SQT is a system level test conducted by the Army developmental tester using live data files supplemented with user-prepared data and executed on target hardware. Conversion procedures and special training requirements are introduced as additional elements for verification and validation. The objectives of the SQT are to have the government confirm the design will meet the performance/user requirements and to determine the adequacy of any corrective action indicated by previous testing. System users participate in the technical and functional aspects of the SQT.

3-18. Production testing

Production testing is required to determine the producer's performance in producing items that meet prescribed TDP requirements, to provide test data for materiel release action, and to ensure that the products continue to meet the prescribed requirements. Program funding category - Procurement.

a. First Article Test (FAT). FATs are conducted post-MS III to ensure the contractor can furnish a product that conforms to all contract require- ments for acceptance (Federal Acquisition Regulation (FAR), Subpart 9.3). Requirements for FATs are invoked in production contracts by citation of the applicable FAR first aritcle inspection and approval clause. When a FAT is specified in a contract, it may not be waived or changed without prior approval of the head of the contracting activity. Tests may be conducted at government facilities or at contractor facilities when observed by the govern-ment. Requirements for the FAT should be consistent with those of the PQT.

b. Production Qualification Test (PQT). A system level DT conducted post-MS III to verify that the production item meets contract requirements, determine the adequacy of any corrective action indicated by previous (pre-MS III) tests, and validate the manufacturer's facilities, procedures, and processes. Within the Army, this test provides data for the independent evaluation for materiel release so that the evaluator can address the adequacy of the materiel with respect to the stated requirements. Materiel release is accomplished during the first post-MS III production contract and is repeated if the process or design is

significantly changed, if a second source for the system or major components therein is brought on line, or if a significant break in production occurs. PQT will also provide a baseline for post-production testing. The PQT may include tests which are not included in the data package or contract (e.g., environmental extremes, test-to-failure) when necessary to obtain engineering data for corrective action verification.

c. Follow-on Production Test (FPT). A DT conducted on full production models to verify the adequacy of corrective actions indicated by the PQT or to determine production acceptability. FPTs are structured similarly to PQTs.

d. Comparison Test (CPT). A CPT is a test of random samples from production and is conducted as a quality assurance measure to detect any manufacturing or quality deficiencies that may have developed during volume production which could reduce effective operation of the item or result in item degradation. CPT is conducted or supervised by an agent independent of the producer or Government on-site quality assurance personnel. CPT may be conducted at procuring agency facilities, Government testing installations, or contractor facilities.

e. Quality Conformance (Acceptance) Inspections. These inspections are examinations and verification tests normally prescribed in the TDP for performance by the contractor and subject to performance or witnessing by the on-site Quality Assurance Representative on the items, lots of items, or services to be offered for acceptance under a contract or purchase order. These examinations and tests include, as necessary, in-process and final measurements or comparisons with technical quality characteristics required to verify that materiel meets all the terms of the contract and should be accepted by the Government.

f. PDSS Test. Developmental test that is conducted during post-deployment software support to assure that software modifications meet requirements, do not impair existing functions or performance, can be employed by users, and are effective and suitable.

3-19. Post-production testing

Post-production DT is conducted to assure that materiel, which is stored, reworked, repaired, renovated, rebuilt, or overhauled after initial issue and deployment, conforms to specified quality, reliability, safety, and operational performance standards. Program funding category - O&MA.

a. Surveillance Tests. Include destructive or nondestructive

tests of materiel in the field or in storage at field/depot/extreme environmental sites. They are conducted to determine suitability of fielded or stored materiel for use; evaluate the effects of environments; measure deterioration; identify failure modes; and to establish/predict service and storage life. Surveillance test programs may be at the component-through-system level. System level programs may include dedicated hardware allocated for this purpose, fielded materiel, or supplies in storage. Storage sites may include depots, field storage, or extreme environmental locations. "Libraries" of component parts to provide a baseline for subsequent surveillance test data comparisons may be established at contractor or government facilities.

b. Reconditioning Tests. The reconditioning test type includes the following categories:

(1) Pilot reconditioning tests are conducted to demonstrate the adequacy of the documented technical requirements, processes, facilities, equipment, and materials that will be used during volume reconditioning activities. The pilot model will be reconditioned in strict accordance with the above. Pilot reconditioning testing relates to PQTs during production. Pilot reconditioning tests will be applied when DMWRs, TMs, or TBs are used the first time or when major changes are made.

(2) Initial reconditioning tests are conducted to demonstrate the quality of the materiel when reconditioned under volume (rate) procedures and practices. These tests relate to FATs during production. Initial recon- ditioning tests will be conducted when an item is reconditioned for the first time by a government or contractor facility, when changes in processes or facilities occur, or when there has been a significant break in reconditioning operations.

(3) Control Tests. Control tests are conducted on randomly selected items from volume reconditioning operations to verify that the process is still producing satisfactory materiel. Criteria should be the same as for initial reconditioning tests. These tests relate to CPTs during production.

(4) Acceptance Tests. Acceptance tests are conducted on in-process materiel and at the completion of reconditioning activities, and upon which an accept/reject decision is based.

(5) Baseline Evaluation Test (BET). BETs are conducted simul- taneously on reconditioned and new production materiel of

the same configuration to provide a comparison of performance and to determine the degree of reconditioning required. BET will be considered when the item is being reconditioned for the first time, when significant modifications affecting performance are incorporated, or to provide data upon which to base a decision on upgrading versus new procurement.

Section VI
Developmental Test Facilities

3-20. General
The Army maintains and operates a group of test centers for the efficient accomplishment of developmental testing for research and throughout all phases of acquisition. These test centers have evolved as specialized and general purpose ranges and test facilities, with capabilities which cover the full range of Army systems. The capabilities of each of the Army developmental test facilities is described briefly in the following paragraphs. The descriptions are not meant to be all-inclusive. Additional detail may be obtained directly from the test center's parent command.

3-21. Combat Systems Test Activity
U.S. Army Combat Systems Test Activity (USACSTA), Aberdeen Proving Ground, Maryland, is a Major Range and Test Facility Base activity of the U.S. Army Test and Evaluation Command. USACSTA tests vehicles, armors, munitions, weapons, general equipment, robotic vehicles, and individual clothing and equipment. Facilities include instrumented firing ranges for small arms, mortars, artillery out to 22,000 meters, and tank gunnery; all standardized vehicle test courses; live fire test facilities for vehicles, ship structures, and explosive targets involving depleted uranium armor or projectiles; and a full array of environmental facilities to satisfy the testing requirements of MIL-STD 810 as well as electromagnetic interference, and pulse radiation. Unique facilities include moving target simulators, high energy and flash radiography, and waterway related test ranges.

3-22. Dugway Proving Ground
U.S. Army Dugway Proving Ground (DPG), Dugway, Utah, is a Major Range and Test Facility Base activity of the U.S. Army Test and Evaluation Command. DPG tests chemical and biological materiel, smoke, obscurants, and incendiary devices, artillery and mortars, and tropic natural environmental effects on all materiel. Facilities include instrumented outdoor test grids to measure

effectiveness of smokes, obscurants, and dispersal of chemical munitions using simulants; chemical and biological laboratories; an indoor test chamber to subject systems as large as a tank to chemical, biological, and environmental challenges; and mortar and artillery ranges out to 65,000 meters. Facilities also include a remote test site in Panama to test the full range of Army weapons systems, clothing and individual equipment for effects of operation and long term exposure in natural tropical environments.

3-23. Electronic Proving Ground
U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Arizona, is a specialized Major Range and Test Facility Base activity of the U.S. Army Test and Evaluation Command. USAEPG tests systems with regard to communications, command and control, optics and electro-optics, intelligence, electronic warfare, avionics, and TEMPEST. Facilities include an instrumented test range, an electromagnetic environmental test facility, environmental facilities to satisfy the requirements of MIL-STD 810, a stress loading facility to provide a threat electromagnetic environment and measure the full load performance of communications systems, and many unique specialized facilities for testing of antennas, radars, remotely piloted vehicles, and computer software.

3-24. White Sands Missile Range
U.S. Army White Sands Missile Range (WSMR), New Mexico, is a Major Range and Test Facility Base activity of the U.S. Army Test and Evaluation Command. WSMR tests missile systems and related materiel, air defense systems, laser weapons systems, and nuclear effects on all systems. Facilities include on-range and off-range missile launch facilities providing up to 800 miles over-land trajectory, flight ranges highly instrumented with radars, cinetheodolites, telemetry, optics, laser trackers and command control and command destruct systems, a laser test range, and target drone control facility. Specialized environmental facilities provide nuclear effects, electromagnetic radiation, microbiological, climatic and dynamic test environments.

3-25. Yuma Proving Ground
U.S. Army Yuma Proving Ground (YPG), Yuma, Arizona, is a Major Range and Test Facility Base activity and the desert natural environmental test center of the U.S. Army Test and Evaluation Command. YPG tests long range tube artillery, automotive systems, tank armament, aircraft armament, air delivery, air transport, remotely piloted vehicles, and natural desert environmental effects on all weapons systems and materiel. Facilities include fully instrumented land and water air delivery

drop zones, firing ranges from small arms to artillery out to 75,000 meters, air to ground aircraft armament range, tank gunnery range, navigation system range, and a full array of ground vehicle mobility test courses. The hot-dry natural desert environment provides diverse terrain representative of almost all of the world's desert areas.

3-26. Kwajalein Atoll
U.S. Army Kwajalein Atoll (USAKA), Republic of the Marshall Islands, is a Major Range and Test Facility Base activity of the U.S. Army Strategic Defense Command. USAKA provides range, radar tracking, impact scoring, recovery, and telemetry data collection for intercontinental ballistic missiles, orbital objects, and reentry vehicles. Facilities include a broad range of instrumentation, tracking, imaging, and splash detection radars, hydroacoustic impact timing, and optical and video sensors. The natural configuration of the atoll facilitates tracking and recovery of reentry vehicles.

3-27. Cold Regions Test Center
U.S. Army Cold Regions Test Center (USACRTC), Fort Greely, Alaska, is the natural cold environmental test center of the U.S. Army Test and Evaluation Command. CRTC conducts basic cold environment tests on all materiel as prescribed by AR 70-38. Facilities include artillery ranges to 55,000 meters, tank ranges to 4000 meters, vehicle courses, chemical (simulant) and smoke test grids, mobile instrumentation vans, ski trails, and large expanses in which to test full systems operationally in the natural winter environment. Conditions include snow to seven feet deep, ice fog, permafrost tundra, temperatures in the -5° to -25° F range during most of the winter, with temperatures often dipping below -50° F.

3-28. Jefferson Proving Ground
U.S. Army Jefferson Proving Ground (JPG), Madison, Indiana, is a test center of the U.S. Army Test and Evaluation Command. JPG performs primarily production and post-production testing of artillery ammunition and ammunition components, bombs, grenades, and conventional and smart mines. Facilities include munitions assembly plants and environmental conditioning facilities, instrumented artillery ranges to 23,000 meters, specialized ranges and firing positions for direct fire testing, weapons, smoke and illumination projectiles, fuzes, depleted uranium ammunition, and weapons proofing.

3-29. Aviation Technical Test Center
U.S. Army Aviation Technical Test Center (USAATTC), Fort Rucker,

Alabama, is a test center of the U.S. Army Test and Evaluation Command. USAATTC tests performance, suitability, and airworthiness of fixed and rotary wing aircraft, aircraft components, subsystems, and related ground support equipment. Facilities include a static engine test cell, inflight performance recorders, and ranges for the firing of aircraft weapons systems. Facilities also include an airworthiness qualification test site at Edwards Air Force Base for the conduct of safety and technology test and evaluation of aircraft systems and subsystems.

3-30. Redstone Technical Test Center

U.S. Army Redstone Technical Test Center (USARTTC), Redstone Arsenal, Alabama, is a test center of the U.S. Army Test and Evaluation Command. USARTTC tests small rockets and guided missiles. Facilities include fully instrumented flight ranges up to 8000 meters, 1000- and 2000-meter dynamic test sled tracks, static rocket motor test facilities for up to 10 million pounds of thrust, and electromagnetic, lightning, and portable climatic environmental facilities for testing missiles, rockets, and explosive warheads. Facilities are also available for testing of electro-optical devices under simulated battlefield countermeasures and obscurants.

Section VII
Requesting Technical Test Services

3-31. General

This section provides procedures for requesting developmental test services from U.S. Army Test & Evaluation Command (TECOM). It includes procedures for requesting developmental testing and related support requirements as well as procedures for identifying future requirements involving TECOM facilities and resources.

3-32. Program Planning Forecasts

a. The Program Planning Forecast is a mechanism designed to identify future testing requirements. It serves a dual purpose: providing a forecast of requirements for developmental testing from the materiel developer to TECOM and providing a preliminary budget estimate and test schedule from TECOM to the materiel developer. The planning forecast is not a firm commitment by either party for developmental testing, but is preliminary notification that developmental testing may be required at some point in the future.

b. The forecast permits the Army to identify future requirements for developmental test resources and provides a quantitative basis for test priorities and allocation of resources. It also supports requirements for facility development or upgrade, instrumentation development and acquisition, and test methodology studies, as well as justification for MCA plans.

c. For program planning forecasting, future testing requirements are generally those scheduled to occur beyond the next 180 days and cover the current FY, the budget FY, and the POM years. If requirements can be forecasted beyond the POM years, it is beneficial. To initiate a program planning forecast, the materiel developer should provide the information reflected at figure 3-1.

(INSERT FIGURE 3-1)

d. Developing/updating of the program planning forecast is essential and should be accomplished throughout the acquisition cycle. This can be done efficiently and effectively by an exchange of information throughout the T&E planning process:

(1) As early in the acquisition cycle as possible, as T&E requirements are being considered during concept exploration and definition.

(2) During the preparation/review of the TEMP.

(3) As a result of negotiations at TIWG meetings.

(4) During program reviews, test coordination meetings, etc.

Major updates will result in a revised budget estimate being provided to the materiel developer.

3-33. Firm requests for testing requirements

a. Firm test requests should be submitted as early as possible to allow TECOM to plan, coordinate, and schedule resources and ensure that required safety, security, and environmental concerns have been properly addressed prior to the test. If the requirement was previously identified via a program planning forecast, the transition to a firm request is accomplished smoothly and efficiently as most of the detail has been previously provided.

b. The firm test request should include the information reflected at figure 3-2.

(INSERT FIGURE 3-2)

c. Additionally, the firm test request should include documentation required by regulation to be provided prior to conduct of developmental testing. This documentation includes Safety Assessment Report, Security Classification Guide, and environmental documentation (e.g., REC, EIS, EA). If these documents are not available at the time the test request is submitted, the request should reflect a date as to when the documentation will be provided.

d. Any other documentation or information which would enhance TECOM's understanding of the test effort should be included.

3-34. Submissions
Both firm requests and program planning forecasts should be submitted to the Commander, TECOM, ATTN: AMSTE-TA-O, Aberdeen Proving Ground, MD 21005-5055. Requests may also be provided via e-mail (amstetao@apg-9.army.mil) or facsimile (DSN 298-9170 or Commercial (410) 278-9170).

Chapter 4
DT&E Reporting and Documentation

Section I
Developmental Test Readiness Review (DTRR)

4-1. General
DTRR is conducted to determine if the materiel system is ready for developmental testing. As a minimum, the DTRR is conducted prior to PPQT for materiel systems or the Software Qualification Test (SQT) for information systems for all ACAT I and ACAT II programs.

4-2. DTRR Working Group
The DTRR working group, whose members include the parent TIWG members plus others deemed appropriate, reviews all pre-start activities and requirements which may impact the execution of the test as planned by the TIWG. The objective of the review is to determine what actions are required to assure that resources, training, and test hardware will be in place to support the successful conduct of the test, and to ensure that the T&E planning, documentation, design maturity/configuration, and data systems have been adequately addressed.

a. The DTRR working group is composed of a representative from each of the following:

(1) Materiel Developer (Chair).

(2) Materiel Developer's Safety Office.

(3) Materiel Developer's ILS Office.

(4) MANPRINT representative.

(5) Materiel Developer's Product Assurance & Testing Office.

(6) Combat Developer.

(7) Developmental Tester.

(8) Operational Tester.

(9) Developmental Evaluator/Assessor.

(10) Operational Evaluator.

(11) Logistician.

(12) Trainer.

b. The DTRR working group should be formed for all ACAT I and ACAT II programs. For ACAT III and ACAT IV programs, establishment of a working group is at the discretion of the materiel developer and the developmental tester. In cases where a full DTRR is not conducted, the materiel developer should conduct an internal DTRR to assure that the item/system can successfully complete the planned testing. This DTRR should be chaired by an independent organization within the command.

4-3. Procedures

a. The chairperson, after initial coordination with the membership, notifies and provides each member a DTRR package and a pre-DTRR checklist (see Figure 4-1 at the end of this chapter). Notification of the time and location of the review plus the DTRR package should be provided at least 2 weeks before the review to allow members to determine if representation by their organization is required and to effect preliminary internal coordination. Member agencies determine the extent of their representation. Since all representatives may not attend each review, the chairperson may indicate recommended attendance.

b. As applicable, the DTRR package consists of the following documentation:

(1) A TIWG coordinated TEMP.

(2) Developmental IEPs and TDPs and operational TEPs.

(3) Safety Assessment Report.

(4) Applicable Environmental Document.

(5) Current test hardware configuration.

(6) RAM Failure Definition/Scoring Criteria.

(7) A statement of the status of the SSP.

(8) A statement of the status of New Equipment Training (NET).

(9) A statement of the status of MANPRINT.

(10) A statement of the status of instrumentation and data collection and reduction facilities.

(11) An ISLMT approved ILSP.

(12) An airworthiness statement.

(13) A statement on status of software.

c. After coordination with all participants, the DTRR working group will be convened at the call of the chairperson.

d. The DTRR working group makes recommendations regarding all issues regarding T&E planning. Each representative has the responsibility to advise participating members in test matters considered to be of mutual concern.

e. In the event of disagreement among the members, issues are presented to the chairperson for resolution through normal command/staff channels.

f. The chairperson provides minutes of the DTRR which include a Developmental Test Readiness Statement. This statement verifies that the system is ready for developmental testing, or if there are action items identified during the review that must be satisfied before test can begin, the minutes will identify such actions. The materiel developer will ensure that all requirements are satisfied before the test begins. The minutes including all recommendations, issues, and required actions are distributed to each DTRR participant 10 working days after the DTRR.

Section II
Test Incident Reports and Related Reports

4-4. General
Timely reporting of test results is essential and is accomplished through Test Incident Reports (TIR) as well as the formal test reporting procedures. TIRs are prepared by the test organization (Government or contractor) to provide the results of any incident occurring during testing. In response, the materiel developer prepares a Corrective Action Report (CAR) for all critical or major TIRs which reflect the developer's analysis of the problem. Details of test incidents and related reporting are contained in Part One of this pamphlet.

Section III
Independent Evaluation/Assessment Plan

4-5. General
The developmental IEP/IAP is formulated by the developmental evaluator/assessor in close cooperation with the TIWG members to ensure the intent of all technical parameters is reflected.

4-6. Contents
The IEP/IAP, as a minimum, contains a brief system description, the technical parameters (both critical and noncritical) and criteria for the evaluation of each parameter; the approach and methodology for evaluation; data requirements/sources; a description of that portion of the evaluation which will require data from sources other than test, and identification of program constraints. The plan must address system performance, RAM, vulnerability/survivability, electronic interoperability, transportability, MANPRINT, safety, etc.

4-7. Technical Parameters
As developmental evaluation issues (parameters) are satisfactorily resolved, they are retained and annotated in the IEP/IAP. Those requiring more evaluation or revalidation are included in the next evaluation activity, and new issues are added, as appropriate. Data source matrices and test documents (if needed) are revised accordingly. The approved IEP/IAPs are furnished to all members of the TIWG. IEPs and associated TDPs, which are submitted to organizations external to the Army for review and/or approval, are forwarded through the DUSA(OR).

Section IV
Developmental Test Design Plan (TDP)

4-8. General
The TDP guides the development of data required for the independent evaluation/assessment. It is prepared by the developmental IE/IA and coordinated with the TIWG members. The TDP for combined tests should expand on both the developmental IEP and operational TEP. For test programs being assessed by TECOM, the TDP is incorporated into the IAP.

4-9. Content
a. The TDP addresses all developmental test parameters and reflects all program constraints (dollars, test quantities, schedules, issues, etc.). Additionally, the TDP must spell out

the form in which the data are needed and the accuracy with which they must be measured.

b. The TDP must be adequate to permit the developmental tester to develop a DTP in a timely manner to permit the development of test facilities with no program delays. It must clearly define the evaluator/assessor's requirements for data. Detailed coordination between the evaluator/assessor and the developmental tester is necessary throughout the process.

c. As a minimum, the TDP will contain the appropriate reliability test strategy, sample sizes, design of tests/ experiments, minimum test requirements to measure performance specified, requirements for data and the process by which the data will be verified, and identify tests in order of priority to ensure that the more critical data are generated early.

Section V
Developmental Detailed Test Plan

4-10. General
The developmental Detailed Test Plan (DTP) is prepared by the developmental test activity. It is derived from and implements the IEP/IAP and the TDP, and provides explicit instructions for the conduct of developmental tests and subtests.

4-11. Coordination
The DTP governs test control, data collection, data analysis, and the necessary administrative aspects of the test program. The DTP must be coordinated with the appropriate developmental IE/IAs and may be coordinated with TIWG members to ensure that the evaluation/assessment reflects the requirements of the TEMP and TDPs.

4-12. Content
As a minimum, the DTP should address the test objective, test concept, system description, test personnel requirements, test criteria, test schedule, and required coordination. Each subtest should be addressed separately, stating the criteria to be addressed by the subtest, the data to be obtained during the test, and the procedures to be used. These should be described in sufficient detail to reflect what will occur during the test. Military Standards (MIL-STDS) and Test Operating Procedures (TOPs) should be used, if possible, and referenced in the DTP.

Section VI
Test Report

4-13. General
Contractor and Government test agencies provide to TIWG members and the decision review body a copy of the TR at the conclusion of the test. For extended test phases, an interim TR is submitted at least annually. Test results must be comprehensive and complete before presentation to the milestone decision authority.

4-14. Requirements
As a minimum, final draft TRs, authenticated by the test agency head, are required prior to decision reviews. This is in consonance with policy regarding other documentation supporting the acquisition of a weapons system. In order to facilitate this, the PEO chairs a T&E review 30 days prior to decision review. The purpose is to review the adequacy of past tests, test results and evaluations, planning for future testing, and the modification of test strategy to accommodate the evolving acquisition strategy. Issues not resolved in this forum will be brought to the attention of the DUSA(OR).

4-15. Content
The format of the formal TR parallels that of the DTP. An Executive Digest provides a summary of the significant findings, the test objectives and concept, and a description of the test item. Subtest results, in addition to the objectives, criteria, and test procedure, include test findings and a technical analysis. Appendices include the test program criteria (from the DTP), and, if required, lengthy test data presented as tables, charts, illustrations, etc. The formal test report may include a preliminary determination of deficiencies, shortcomings, and suggested improvements.

Section VII
Developmental Independent Evaluation/Assessment Report

4-16. General
Developmental IER/IARs are prepared by the developmental independent evaluator/assessor and updated as additional data becomes available. Coordination of information contained in the IER/IAR between the testers and evaluators is effected to ensure that test data are accurately reflected in the IER/IAR. This updating process assures the decision authority has the latest

evaluation results. It is the "continuous" in CE. This process highlights those issues that have been answered and require little or no additional analysis as well as those needing further evaluation.

4-17. Requirements

a. The IER/IAR addresses both the critical technical parameters identified in the IEP/IAP and other issues which are appropriate to the specific item. It defines the methodology used to characterize materiel performance (effectiveness, RAM, survivability, mobility/ transportability), logistics, MANPRINT, and safety.

b. As a general rule, developmental IER/IARs are prepared prior to MS decision reviews. However, for very small programs, such as a simple modification, an expanded TR may suffice. This determination will be made jointly by the developmental tester and the developmental independent evaluator/assessor.

4-18. Content

IER/IARs contain, as a minimum, background and system description, the evaluation/assessment of each technical parameter (both critical and noncritical), the safety confirmation, and conclusions and recommendations.

Section VIII
Outline Test Plan (OTP)

4-19. General

The OTP, as defined in Part Five, is required to obtain OT resources; however, if DT requires the use of user troops beyond resources, the developmental tester also prepares a draft OTP to obtain troop and equipment support. This will permit early planning for the resources to be provided through the Test Schedule and Review Committee (TSARC) process (e.g., U.S. Army Forces Command (FORSCOM), U.S. Army Training and Doctrine Command, U.S. Army Pacific Command) and for resource support through the FYTP process. (See AR 15-38.)

Section IX
Test & Evaluation Master Plan (TEMP)

4-20. General

The developmental testers and evaluators/assessors are primary

players in the development of the TEMP. (For additional guidelines on the TEMP, see Part Two.)

4-21. DT&E Input

a. As input to Part I, the developmental independent evaluator/ assessor, in coordination with the combat developer, the materiel developer, and the developmental tester, develop the critical technical parameters (see Section XV).

b. Both the evaluators/assessors and the testers provide support to the materiel developer in the development of Part II, the Integrated Test Program Summary.

c. Part III, Developmental T&E Outline, which provides an overview of the entire DT&E program, is developed jointly by the developmental tester and the developmental evaluator/assessor. This section of the TEMP outlines the objectives of DT&E, identifies the DT&E that has been completed, discusses the DT&E to be conducted with emphasis on the next phase of the acquisition cycle, and includes a description of LFTE, if applicable.

d. The developmental tester and evaluator/assessor have a substantial role in the development of Part V, T&E Resource Summary, which provides a summary of all T&E resources:

(1) Test Articles. The developmental evaluator/assessor, in coordination with the developmental tester, identifies the number of test articles required and when they will be needed.

(2) Test Sites and Instrumentation. The developmental tester, with support from the evaluator/assessor, identifies the test range/facility and the instrumentation that will be required for each test to be conducted. Details on acquiring needed instrumentation are in Part Eight of this pamphlet.

(3) Test Support. The developmental tester determines what support equipment is required, and, if not available, what must be acquired for the specific test program.

(4) Threat Systems/Simulators. The developmental tester assists in determining the requirements for and availability of current assets and the sufficiency of those capabilities.

(5) Test Targets and Expendables. The developmental tester identifies the type, number, and availability requirements for targets and other expendables, including ammunition, threat targets for lethality testing, and threat munitions for

vulnerability testing. Details for obtaining necessary targets and threat simulators are outlined in Part Eight.

(6) Simulation, Models, and Testbeds. The developmental independent evaluator/assessor identifies the system simulations required for the developmental T&E and the resources required to validate and certify their use.

(7) Special Requirements. The developmental evaluator/ assessor, in conjunction with the developmental tester, identifies any significant non- instrumentation capabilities required for the developmental T&E.

(8) T&E Funding Requirements. The developmental tester provides an estimate of the funding required to pay direct costs for the developmental tests required to be conducted at government ranges and test facilities.

(9) Manpower/Personnel Training. The developmental tester identifies the key manpower/personnel and training required for developmental T&E. These requirements must be identified, to the degree known, at Milestone I.

Section X
Summary of DT&E Documents

4-22. General
There are many documents required to plan and report on the T&E that takes place during the life cycle of a system. To provide a summary of the specific documents required within the DT&E arena, the following information provides a brief description, source references, and the activity with primary responsibility for the document.

4-23. DT&E planning documents
a. T&E Master Plan

(1) Reference: DODI 5000.2, DOD 5000.2-M, AR 73-1.

(2) Responsibility: Materiel Developer

(3) Summary: The T&E Master Plan is the basic planning document for all life cycle T&E related to a particular system acquisition and is used in planning, reviewing, and approving T&E activities, and must be approved prior to the start of any testing. The T&E Master Plan addresses the T&E to be

accomplished in each phase of the life cycle. (See Part Two of this pamphlet.)

b. Developmental Independent Evaluation/Assessment Plan (IEP/IAP).

(1) Reference: AR 73-1.

(2) Responsibility: Developmental IE/IA. The IEP/IAPs are prepared in close coordination with the TIWG members.

(3) Summary: The developmental evaluator/assessor prepares an IEP/IAP which details all aspects of developmental evaluation responsibilities relative to the system throughout its acquisition cycle. The IEP/IAP supports the TEMP by addressing the issues for testing; describing evaluation of issues which require data from sources other than tests; stating the technical parameters; identifying data sources; providing the approach to the evaluation; and identifying program constraints.

c. Developmental Test Design Plan (TDP).

(1) Reference: AR 73-1.

(2) Responsibility: Developmental IE/IA. Developmental TDPs are coordinated with TIWG members.

(3) Summary: The TDP is responsive to the technical parameters. It includes a complete test design; a description of required tests; the conditions under which the system will be tested; and a statement of test criteria and test methodology. The TDP also specifies data requirements and includes plans for data collection and analysis. Developmental TDPs will address government and may address contractor testing/modeling/simulation efforts, if appropriate. For assessed programs, the TDP is included in the IAP.

d. Outline Test Plan (OTP).

(1) Reference: AR 15-38 and AR 73-1.

(2) Responsibility: Usually the OT; however, if supplementary operational troops are required for DT, the developmental tester also prepares an OTP.

(3) Summary: The OTP is a formal resource document submitted for the TSARC review. All acquisition programs must have an Army-approved TEMP prior to competing in the TSARC

process for resources and commitments to provide such resources. The document contains a listing of the resources required and the administrative information necessary to support the test. The document also contains the critical test issues, test conditions, a brief scope, suspense dates, test milestones, and cost estimates.

e. Five Year Test Program (FYTP).

(1) Reference: AR 15-38 and AR 73-1.

(2) Responsibility: OPTEC.

(3) Summary: The FYTP is a compendium of OTPs approved by HQDA (DCSOPS) for the Chief of Staff, U.S. Army. The document identifies validated requirements to support operational tests as well as those DTs for which operational troops are required. It is a tasking document for the current and budget years and provides test planning guidelines for the out years.

f. Detailed Test Plan (DTP).

(1) Reference: AR 73-1.

(2) Responsibility: Organizations responsible for conduct of test.

(3) Summary: The DTP provides explicit instructions for the conduct of tests and subtests. It is derived from and implements the TDP. The DTP governs test control, data collection, data analysis, and the necessary administrative aspects of the test program. There may be one or several DTPs depending on the complexity of the program and the number of test sites or test organizations involved in providing data. The DTP must be coordinated with appropriate IE/IAs and may be coordinated with other TIWG members to ensure that the evaluation/assessment reflects the requirements of the TEMP and TDPs. DTPs for LFTE are approved by the DUSA(OR).

4-24. DT&E Reporting Documents

a. Test Incident Report (TIR).

(1) Reference: AR 73-1 and AR 702-3.

(2) Responsibility: Organization responsible for conduct of tests.

(3) Summary: TIRs are used as the medium to provide the results of any incident occurring during test, report the results of subtests, and serve as interim reports.

b. Corrective Action Report (CAR).

(1) Reference: AR 702-3 and AR 73-1.

(2) Responsibility: Materiel Developer.

(3) Summary: The CAR reflects the developer's analysis of the problem reported by the TIR and the status/description of corrective action or report that no corrective action is proposed. CARs are prepared for major and critical TIRs.

c. Test Report (TR) and Expanded TR.

(1) Reference: AR 73-1.

(2) Responsibility: Organization responsible for conduct of tests.

(3) Summary: The TR is a formal document of record which reports the data and information obtained from the conduct of test and describes the conditions which actually prevailed during test execution and data collection. For ACAT IV systems which do not have DOT&E oversight, an expanded TR may be written. An expanded TR is a test report with evaluative content which is endorsed by the evaluator in lieu of a separate evaluation.

e. Developmental Independent/Assessment Evaluation Report (IER/IAR).

(1) Reference: AR 73-1.

(2) Responsibility: Developmental IE/IA.

(3) Summary: The IER/IAR provides the independent evaluation of the system and is based on test data, reports, studies, simulations, and other appropriate sources. It also contains the independent evaluator's assessment of the parameters, conclusions, and position on the future capability of the system to fulfill the approved requirements. The IER/IAR will contain an assessment of the adequacy of testing and the need for additional testing, and will identify program constraints and their impact on the evaluation.

4-25. Supporting documents

a. Record of Environmental Consideration (REC).

(1) Reference: AR 200-2.

(2) Responsibility: Materiel Developer.

(3) Summary: Briefly describes a proposed action and contains a checklist explaining why further analysis is not necessary. It is used when a categorical exclusion applies and there is no measurable impact to the environment.

b. Environmental Assessment (EA).

(1) Reference: AR 200-2.

(2) Responsibility: Materiel Developer.

(3) Summary: Addresses new and continuing activities where the potential exists for measurable degradation of environmental quality. This document concludes with either a finding of no significant impact or a statement that an environmental impact statement is necessary.

c. Environmental Impact Statement (EIS).

(1) Reference: AR 200-2.

(2) Responsibility: Materiel Developer.

(3) Summary: If the EA shows that the system will impact the environment adversely, or is controversial, an EIS is prepared. It provides full discussion to the public on all issues associated with a Federal action that has the potential to significantly impact the natural environment. If required, testing is performed to identify and quantify the environmental quality issues.

d. Health Hazard Assessment Report (HHAR).

(1) Reference: AR 40-10.

(2) Responsibility: Materiel Developer.

(3) The HHAR is the formal document used to provide an analysis and assessment of health hazard issues. It also provides recommendations for eliminating or controlling hazards. It is required for the development of the Safety Assessment Report.

e. Safety Assessment Report (SAR).

(1) Reference: AR 385-16, AR 40-10, and AR 73-1.

(2) Responsibility: Materiel Developer.

(3) Summary: The SAR contains data and information relative to personnel and equipment hazards inherent in the system and any associated operation and maintenance hazards. An assessment of the data will be provided and will be the basis for obtaining a Safety Release. Government system level testing cannot begin until the SAR is received, reviewed, and accepted by the test organization.

f. Safety Release (SR).

(1) Reference: AR 73-1 and AR 385-16.

(2) Responsibility: TECOM/HSC/MRDC/ISC.

(3) Summary: The SR is required before involving soldiers in testing. The SR documents the precautions that must be taken by the soldier to avoid system damage and personal injury. The release is based on the results of DT and data presented in the SAR.

g. Safety Confirmation.

(1) Reference: AR 73-1 and AR 385-16.

(2) Responsibility: TECOM.

(3) Summary: The Safety Confirmation provides the safety findings and conclusions and states where the specified safety requirements/specifications were met. The Safety Confirmation is included in the developmental IER/IAR.

h. Human Factors Engineering Assessment (HFEA).

(1) Reference: AR 602-1.

(2) Responsibility: AMC.

(3) Summary: The HFEA summarizes the HFE issues based on the results of human engineering analyses, system testing, and evaluation. The T&E input should be in the HFE design, soldier-machine interface, system safety, methodology, data, and reports areas.

i. System Safety Program Plan (SSPP).

(1) Reference: AR 385-16 and MIL-STD 882.

(2) Responsibility: Materiel Developer.

(3) Summary: Implements system safety engineering program that will assess the safety of the system, and assures that the system meets the user's safety requirements and regulatory safety standards.

j. System MANPRINT Management Plan (SMMP).

(1) Reference: AR 602-2.

(2) Responsibility: TRADOC and Materiel Developer.

(3) Summary: Summarizes program/plan to address MANPRINT concerns throughout the MAP.

k. System Support Package Components List (SSPCL).

(1) Reference: AR 700-127.

(2) Responsibility: Materiel Developer.

(3) Summary: A list of the components in the SSP provided to the TIWG/ILS Management Team for review and furnished 60 days before the test begins.

l. Integrated Logistics Support Plan (ILSP).

(1) Reference: AR 700-127.

(2) Responsibility: Materiel Developer.

(3) Summary: Outlines the entire ILS strategy for a materiel system.

m. System Training Plan (STRAP).

(1) Reference: AR 350-35.

(2) Responsibility: TRADOC.

(3) Summary: Outlines training strategy for a developing system. Sets milestones for development of the Training Product.

n. NET Plan.

(1) Reference: AR 350-35.

(2) Responsibility: TRADOC/Materiel Developer.

(3) Summary: Sets training dates for test player instructor evaluation and test personnel and training strategy to support unit fielding.

Chapter 5
DT&E Considerations

Section I
Reliability, Availability, & Maintainability (RAM)

5-1. General
The operational RAM values specified by the requirements documents are translated into technical requirements by the RAM Rationale Working Group. The technical RAM requirements are translated into DT&E requirements by the developmental independent evaluator/assessor. Plans must be specifically oriented to provide the test data required to assess the probable achievement of the RAM values.

5-2. RAM scoring conference
RAM scoring conferences are held before publication/release of the test report and are chaired by the materiel developer for DT and by the operational evaluator for operational tests. Voting members are the operational evaluator, developmental evaluator, materiel developer, and combat developer. The failure assessment data is obtained from the TIRs and CARs. Decisions are made by a majority vote of the primary spokespersons. If unresolved differences exist, the dissenting opinions are formally documented in the conference minutes. In cases where a majority opinion does not exist, the operational evaluator makes the final determination of incidents scoring for OT and the developmental evaluator, for DT. See Chapter 11, Part One, for more details on scoring conferences.

5-3. RAM assessment conference
RAM assessment conferences, when convened, are chaired by the operational IE and are held before release/ publication of the TR. Attendees at this conference are the same as for the scoring conference. This conference is conducted to discuss and establish the test data base, the procedures to be used in assessing the data, and the demonstrated RAM estimates. The assessment conference is conducted under guidelines similar to those used for scoring conferences, except there is no tie breaking vote. Any changes to the test data base must be by majority opinion. If there is no majority opinion, each member reports his/her own assessment. Minutes of the conference are provided to all attendees. RAM assessment conference procedures are provided in Chapter 11, Part One.

Section II
Electromagnetic Environmental Effects (E3)

5-4. Test and evaluation of E3

To ensure that Army materiel is in compliance with E3 policy, testing under the purview of an Army tester and an independent evaluator/assessor will be conducted. Evaluations will assess the probable inter- and intra-system E3 hardness, as well as provide guidance and theoretical pretest predictions. Early DT&E planning will ensure the use of currently scheduled tests to fully assess the E3 criteria rather than requiring new or increased testing. See Part One for further details on E3.

Section III
Significant Impact Tests

5-5. General

Significant impact tests or demonstrations, i.e., those involving multiple participants, multinational involvement, and those with potential multinational impact require careful planning, staffing, coordination, and approval. These events require detailed attention to the technical aspects and performance of the tests and demonstrations and the early involvement of policy makers.

5-6. Coordination

Prior to the announcement of initiation of significant impact tests, coordination must be effected with both the DUSA(OR) and the Army Acquisition Executive (AAE). In this way, it is ensured that Army policy makers are allowed to review and approve the planning to include public affairs or Congressional notification and news media planning.

Section IV
Manpower and Personnel Integration (MANPRINT) (AR 602-2)

5-7. General

Throughout the acquisition process, MANPRINT will be a factor in all T&E planning. Developmental testing will be planned so as to provide data for the assessment of issues regarding the integration of all MANPRINT domains, i.e., human factors engineering, manpower, training, system safety, and health hazards. This assessment will determine if the item can be

adequately operated and maintained by soldiers representative of the target users, with the proposed system training, and under the expected environment.

Section V
Logistic Supportability (AR 700-127)

5-8. General
Evaluation of materiel supportability is mandatory during both DT and OT. The scope of the evaluation/assessment varies depending on the characteristics of the system and where the program is in the acquisition cycle. The developmental evaluator/ assessor, in coordination with the materiel developer and combat developer, will establish the logistic support parameters to be addressed during test as well as the scope of testing required in each acquisition phase. The System Support Packages (SSP) provided for developmental test and evaluation/assessment will represent the logistic support system that will be provided when a system is deployed in the field. (See Part One for more detailed information on SSPs.)

Section VI
Transportability (AR 70-44, AR 70-47 and AR 700-27)

5-9. General. Transportability refers to the ability of a system to be moved by towing, self-propulsion, or by carrier via railways, highway, air, waterway, or helicopter, and airdrop modes of transportation utilizing existing or planned equipment/containers. Transportability testing is accomplished to support the assessment efforts of the Military Traffic Management Command's (MTMC) Transportation Engineering Agency and to obtain a transportability approval from MTMC. This testing also supports certification for external air transport and airdrop.

Section VII
Health Hazard Assessment (AR 40-10)

5-10. General
Developmental testing provides data regarding personnel health hazards inherent in the operation and maintenance of the system. Planning for this testing must be considered early in the cycle

and continues throughout the acquisition process. Special attention is given to verifying the adequacy of safety and warning devices and any other measures to control hazards. An HHA report is developed by the U.S. Army Environmental Hygiene Agency from data gathered from a variety of sources and includes the results of developmental tests and operational tests to date. The HHA report is required by the materiel developer for preparation of the Safety Assessment Report. HHA issues are addressed in the developmental IEP/IAPs, TPs, and IER/IARs.

Section VIII
System Safety Testing (AR 385-16)

5-11. General
One of the most important objectives of developmental testing is verifying the elimination or control of safety and health hazards. The developmental tester must review the provisions of MIL-STD 882 when formulating the testing program, determining the operational environment, and establishing operator limits.

5-12. Safety Assessment Report
a. Prior to developmental testing, a Safety Assessment Report (SAR) is prepared by the materiel developer. The SAR is the formal, comprehensive safety report which summarizes the safety data that have been collected and evaluated thus far. It expresses the considered judgment of the contractor or developing agency regarding the hazard potential of the item and any actions or precautions that are recommended to minimize these hazards and to reduce the exposure of personnel and equipment to them.

b. The SAR is provided by the materiel developer to the combat developer, OT agency, and DT agency at least 60 days before start of their respective tests. Government DT will not begin until an SAR has been received, reviewed, and accepted by the test agency. The test agencies --

(1) Use the SAR information to integrate system safety into test planning and into procedures and for shipping and handling of the system.

(2) Ensure that DT does not begin until an SAR has been received, reviewed, and accepted by the test agency.

c. The SAR format is provided in figure 5-1.

(INSERT FIGURE 5-1)

5-13. Safety Testing

Developmental testing for safety is characterized by systematic testing of materiel using highly technical equipment and instrumentation under laboratory or other rigorously controlled conditions. The tester obtains the hazard tracking list (see DA Pam 385-16 for guidance on structure and procedures for hazard tracking) before starting developmental testing. This list is used with the SAR to identify the remedies that have been applied to correct previously identified hazards. Safety tests are then performed to verify the adequacy of the remedy. Specific safety tests are also performed on critical devices or components to determine the nature and extent of hazards presented by the materiel. All safety testing will be conducted according to the appropriate test operating procedures/ international test operating procedures (TOPs/ITOPs), as available. Use of standard test procedures, as developed in TOPs/ITOPs ensures usability and adequacy of the test data in addressing the safety test objectives.

5-14. Safety Release

No testing (developmental or operational) involving troops will begin until a safety release has been issued to the test organization. For operational testing, the materiel developer should request a safety release as soon as the requirement is known. TECOM is responsible for issuing all safety releases except for systems being developed by ISC, HSC, and MRDC.

a. The Safety Release is a formal document issued to a test organization before any hands-on use or maintenance by troops.

b. The Safety Release indicates that the system is safe for use and maintenance by typical user troops and describes the specific hazards of the system or item based on test results, inspections, and system safety analyses. Operational limits and precautions are included. The test agency uses the data to integrate safety into test controls and procedures and to determine if the test objectives can be met within these limits.

c. A Limited Safety Release can be issued on one particular system.

d. A Conditional Safety Release is issued when further safety data are pending; for example, when all safety tests have not been completed and certain aspects of the test must therefore be restricted.

e. The Safety Release is in the format shown in figure 5-2.

(INSERT FIGURE 5-2)

5-15. Safety Confirmation
Prior to an MS decision, a safety confirmation is provided to the decision maker as part of the IER/IAR. The safety confirmation evaluates the safety findings, states whether the specified safety requirements have been met, and evaluates the risk of proceeding to the next phase of the acquisition cycle. The safety confirmation is provided by the government developmental tester.

5-16. References
Additional details pertaining to system safety are contained in AR 385-16 and DA Pam 385-16.

Section IX
Use of Nontest Personnel and Volumteers in Developmental Testing (AR 70-25)

5-17. General
The safety of test personnel is of paramount concern during testing. Test designers ensure that testers are protected from risks in the performance of their testing duties by scrutiny of the SAR and safety release and review and approval of detailed test plans. AR 70-25, Use of Volunteers as Subjects of Research, requires review of test plans by a Human Use Committee when: testing involves greater than minimal risk or tests are being conducted by military or civilian personnel not qualified to test by duty assignment when the test calls specifically for such qualifications.

Section X
Natural Environmental Testing (AR 70-38)

5-18. General
Environmental testing parameters are derived from the requirements documents and are tailored to each specific system (MIL-STD 810). Test results from environmental chamber tests cannot substitute for test data from natural environment tests; however, the use of chambers can be an effective screening early in the development of the item.

5-19. Climatic Design Types
Developmental test programs must recognize the basic

environmental condition and all the capabilities and limits for which the system is designed. As a minimum, Army weapons systems are designed for the basic climatic design type. The Army recognizes four climatic design types: hot, basic, cold, and severe cold. Generally, all Army equipment must operate in at least the basic climatic design type. Potentially dangerous items (e.g., ammunition) will be tested for safety in all climatic design types despite the chance of them being used in those climates.

5-20. Basic Climatic Design Type
A condensation of the environment descriptions in AR 70-38 for testing in the basic climatic design type is reflected in table 5-1. In order to take maximum advantage of the testing season for the basic climatic design type at the Army's natural environmental test centers, the following must be considered:

(INSERT TABLE 5-1)

a. Basic cold. The winter testing season at the Cold Regions Test Center (Alaska) is from mid-October through mid-March. Test hardware must be delivered by the beginning of the test season (1 Oct). Items received after December are not assured of an adequate test season.

b. Constant and variable high humidity. There are two testing seasons for the Tropic Test Site in Panama. The wet testing season runs from April-November. A drier testing season runs from December-March. The materiel developer should plan for a test of several months for tropic testing in order to realize the synergistic effects of the tropic environment throughout both seasons.

c. Basic Hot. The optimum testing season at Yuma Proving Ground for these effects is from mid-May through mid-September. Test hardware must be delivered by the beginning of the test season. Items received for test after July are not assured of an adequate test season.

5-21. Semi-Protected Environments
Information systems or subsystems which will be operated in semi-protected environments, such as forward area command centers, are also subject to these provisions. Information systems installed and operated in a protected environment do not come under these provisions; however, Environmental Control Units supporting information systems requiring a special environment must be tested or certified by the providing agency to ensure capacity, suitability, and continued support.

Section XI
Integrated Testing

5-22. General
The integration of testing requirements (i.e., combined or concurrent developmental testing/operational testing) mandates a coordinated effort by all members of the acquisition community to ensure that testing is optimized. While developmental testing and operational testing are separate activities conducted by different test communities, they interact frequently and are complementary. Each provides a unique perspective on a program.

5-23. Test Objectives
Developmental testing and operational testing are normally conducted with some degree of concurrency creating a challenge to the testing community to ensure that separate and different test objectives are accomplished without duplication. In those instances when developmental testing and operational testing can be combined to save resources, the separate test objectives must not be compromised. In any case, separate independent developmental and operational evaluations are conducted.

Section XII
Test Data Confirmation

5-24. General
The purpose of test data confirmation is to ensure the widest possible use of data. The TIWG first determines whether or not a need exists to confirm certain test data. A review and assessment is performed of each test and the criticality of the use of the data. This determines which tests require confirmation so the data generated can be used for evaluation purposes. Test data confirmation is determined by the TIWG.

5-25. Acceptability of data
In those instances when a particular facility's ability to provide acceptable data is in doubt, the Government developmental tester, the materiel developer, and the independent evaluator/assessor, if appropriate, inspect the facility to verify acceptability of data. For this reason, it is essential that the TIWG review and coordinate on the T&E portion of the RFP prior to its issuance. The following factors are considered in determining the acceptability of the test data that will be

generated:

a. Ranges, courses, test apparatus, and support equipment available to tester.

b. Laboratory facilities, instrumentation, and calibration available to tester.

c. Test personnel experience and expertise, test procedures, and data collection and reporting procedures used by tester.

5-26. Government Monitoring
In those instances when the test data from a particular source or procedure would not otherwise be acceptable, the evaluator may require data be validated through full or partial monitoring of the testing by government test personnel.

5-27. Confirmation Process
Once the confirmation process has been established, the materiel developer relies upon the government developmental tester to provide assistance in contractual proceedings. Prior to bid solicitation, the materiel developer:

a. Provides the T&E portion of the RFP to TIWG members for coordination and to confirm test data acceptability.

b. Provides to prospective contractors, in the RFP, the option of using government test services, funded directly by the materiel developer. This provides flexibility to the contractors as well as providing the TIWG a known source of acceptable data, should other sources prove unacceptable.

5-28. Contract Requirements
To help ensure acceptability of test data, contracts specify that the contractor:

a. Provides a test plan to the materiel developer for TIWG coordination prior to testing.

b. Reports test incidents to the materiel developer and evaluators.

c. Reports the corrective actions taken in response to test incidents to the materiel developer and evaluators.

d. Provides a test report to the materiel developer and evaluators. (If contractor test data will be used to satisfy certain technical requirements, a copy of the contractor test

report should be provided to the government developmental tester by the materiel developer.)

Section XIII
Environmental Impact (AR 200-2)

5-29. General
Formal environmental documentation is required by Congressional mandates to support all Federal agency actions. Therefore, prior to the initiation of any testing, environmental documentation must be provided by the materiel developer to the developmental tester in accordance with AR 200-2.

5-30. Categorical Exclusions
A categorical exclusion allowed by AR 200-2 pertains to developmental and operational testing on a military installation where tests are conducted in conjunction with normal military training or force maintenance activities producing only incremental impacts, if any, and provided the training/force maintenance activities have been adequately assessed, where required, in other Army environmental documents. Although this type of testing is categorically excluded, a Record of Environmental Consideration is still required.

5-31. Environmental Documentation
See Section XXXII, Chapter 4, for the three levels of environmental documentation which can be submitted. Detailed information and requirements pertinent to environmental documentation are contained in AR 200-2.

Chapter 6
Test Technology

6-1. General
Development and acquisition of test technology (test methods and instrumentation), like weapon systems development, involve an acquisition strategy and require necessary lead times to reach an initial operation capability (IOC). It may require as much lead time to develop the test instrumentation, targets, and threat simulators as to develop the weapon system it will test. PM ITTS (Instrumentation, Targets, and Threat Simulators) is responsible for the design, development, acquisition, and fielding of major instrumentation, targets, and threat simulators (except for strategic defense targets which are developed by SDC). It is important to have the early involvement of PM ITTS to effectively satisfy user needs, especially as the sophistication of the requirements increases.

6-2. Test technology process
Materiel and systems being developed are incorporating more and more advanced technology. With the increased complexity and sophistication of the systems, the testing requirements are more stringent, the testing problems more difficult to solve, and more time is needed to solve those problems. If the development of the system is to proceed smoothly and in a timely manner, it is imperative that test technology efforts begin prior to Milestone I - program initiation. Several related test technology activities, described in the following paragraphs, need to be addressed by the Army test community as early in the acquisition cycle as possible.

6-3. Advanced test technology concepts
The initial effort of the test technology process involves early identification and assessment of emerging weapons development technologies as a basis for determining future test technology requirements. This effort should be initiated with, or prior to, technology base activities and involves close interaction with Army laboratories and development commands. Test requirements (i.e., data parameters and corresponding data accuracies) must be determined and compared with existing capabilities in order to identify and assess test deficiencies. The deficiencies are provided as inputs to methodology, instrumentation, and target development programs as appropriate. To accomplish this, the network of Advanced Systems Concepts Offices at research, development, and engineering centers interface with U. S. Army Laboratory Command, the T&E community, and the PM ITTS.

6-4. Test methodology
Test methodology investigations should precede instrumentation or target developments and identify what methods or techniques are needed to properly test the weapon systems or materiel. When appropriate, the testing methods might be established as standard test procedures so the results of tests conducted at different times or places can be compared and assessed. The identification of needed test instrumentation can be the results of test methodology investigations.

6-5. Instrumentation development
Instrumentation development is necessary only when existing instrumentation within the Army or industry cannot collect the required data. To meet the testing requirements, existing range instrumentation might be modified or new instrumentation developed. The modifications and/or developments can be accomplished in-house or under contract. Refer to Part Eight of this pamphlet for details.

6-6. Targets and threat simulators
The successful testing of weapon system is dependent not only on using proper test instrumentation but also on whether the system is tested in a proper threat environment. If the actual threat system is not available to support required testing, the use of a surrogate target or threat simulator should be used. The surrogate target or threat simulator must realistically represent applicable characteristics of the actual threat system. The degree of fidelity required will change depending upon the materiel system under test and the type of test that is being conducated. Targets must be validated as properly replicating the threat and accredited for the particular test in which they are being used. Refer to Part Eight of this pamphlet for details.

6-7. The Army Test Facilities Register (TESTFACS)
TESTFACS identifies and describes testing capabilities within the U.S. Army. The register provides information about major test facilities and major instrumentation test equipment. Further information regarding TESTFACS is reflected in Part One.

DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART FIVE

OPERATIONAL TEST AND EVALUATION GUIDELINES

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Chapter 1
Introduction

Section I
Overview

1-1. Purpose

This part describes the methods and procedures for implementing current regulations and directives for operational test and evaluation (OT&E). It also describes Continuous Evaluation (CE) by the operational evaluator, and operational testing in field experiments in support of the combat and training development process. The procedures in Part Five of the DA Pamphlet are in accordance with AR 73-1, Test and Evaluation Policy, 30 November 1990, paragraph 1-4. Information in this part applies to the U.S. Army, U.S. Army Reserve and the U.S. Army National Guard.

1-2. Philosophy of testing

a. Extent. The prerequisite for testing is based on the answer to the question: "What don't we know, that we need to know that can be found out only by testing?" The extent to which testing is conducted must provide the answer. Although the time spent is only a small fraction of the complete acquisition cycle, the influence of testing is significant. Experience has demonstrated that where tests have been eliminated or reduced, deficiencies in the system have been overlooked, only to surface after deployment; resulting in expensive and time consuming modifications. Where testing has been adequate and complete, systems have gone to production and deployment sooner than anticipated, thus saving time and money, and with favorable results reflected in the field. Unnecessary duplication of testing efforts, facilities, or programs, however, must be avoided and is a specific responsibility of all concerned.

b. Principles. Operational test and evaluation is conducted in keeping with principles of an objective test and an impartial evaluation to provide to those responsible the operational information necessary to resolve critical issues. Critical issues are those questions that must be answered to enable a decision to be reached. Adherence to these principles is necessary to assure valid estimates of a system's expected operational effectiveness (including vulnerability) and operational suitability (including compatibility, interoperability, reliability, availability, maintainability (RAM), logistic supportability, safety, health, human factors, and trainability). While it is difficult to state established

principles simply (and experienced personnel would differ in their choice of wording), they may be summarized in three terms-adequacy, quality, and credibility.

(1) Adequacy. The amount of data and realism of test conditions must be sufficient to support the resolution of the critical issues.

(2) Quality. The test planning, control of test events, and treatment of data must make the operational information clear and accurate.

(3) Credibility. Test conduct and data handling must be separated from external influence and personal self-interest.

Section II
General Procedures

1-3. General policy

a. This part applies to all materiel systems acquired under the auspices of the AR 70 series regulations, information mission area (IMA) systems acquired under the AR 25 series regulations, and IMA systems in maintenance (post deployment support). It also applies to OT&E of combat and training development products developed under the auspices of the AR 71 series.

b. Acquisition program category designations of materiel systems are explained in figure 1-1, and acquisition program categories of IMA systems are explained in figure 1-2.

1-4. Overview of operational test and evaluation management

a. Policy. For OT&E purposes, acquisition systems are designated as either evaluate or abbreviated evaluate. All systems are operationally tested and evaluated by the U.S. Army Operational Test and Evaluation Command (OPTEC), with the exception of those specialized systems assigned to other OT&E activities; the U.S. Army Health Services Command (USAHSC) for medical materiel, U.S. Army Intelligence and Security Command (USAINSCOM), and Corps of Engineers (COE). (See figure 1-3.) OPTEC's Operational Evaluation Command (OEC) performs the OPTEC evaluation mission. OPTEC's Test and Experimentation Command (TEXCOM) conducts operational and other tests to support and assist the evaluation function. All acquisition category (ACAT) I, ACAT II, and those In-Process Review (IPR)/ACAT III and IV systems on the Director, Operational Test and Evaluation (DOTE)

oversight list will automatically receive the full level of evaluation effort and will automatically be considered as "full evaluation" systems and designated as "evaluate." The remaining ACAT III and IV systems will be designated "abbreviated evaluate."

b. Oversight. Oversight systems are of special interest to the Department of Defense (DOD), and are designated by the Director, Operational Test and Evaluation (DOTE). Systems of special interest to the Army Acquisition Executive, Chief of Staff of the Army, Vice Chief of Staff of the Army, or Deputy Undersecretary of the Army for (Operations Research) (DUSA-OR), are designated as oversight by the Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS). Commander, OPTEC or Commanders of other OT&E activities (USAHSC, USAINSCOM, and COE) can elevate abbreviated evaluate systems to "full evaluation" status. In addition, either the evaluator or tester may recommend elevation of a system to the Commander, OPTEC or other OT&E activity due to the system's complexity, the testing involved, procurement risk, doctrinal change, cost or relationships with other systems.

c. Evaluate. All ACAT ID, IC, II, (figure 1-1) and DOTE oversight programs, (corresponding to the previous category of OTEA evaluated). These evaluated systems will normally have the following characteristic:

(1) Have research, development, test, and evaluation (RDTE) costs of more than $115 million or procurement costs of more than $540 million (FY90 constant dollars).

(2) Are technically evaluated by the Army Materiel System Analysis Activity (AMSAA).

(3) Require data beyond operational test (OT) for operational evaluation purposes.

d. Abbreviated evaluate. Abbreviated evaluate incorporates both the old categories of OTEA Endorsed and Abbreviated Evaluation. Systems for which the operational test (OT) findings would be adequate to support a production or deployment decision will have an abbreviated evaluation by the operational evaluator. In these cases the tester's plan contains all the operational issues needed by the decision maker. The operational tester's report contains evaluative findings and is sanctioned by the operational evaluator before going to the decision maker.

e. Documentation. Documents described in this document, such as, Test and Evaluation Plan (TEP), and the Test and Evaluation

Report (TER) are the only documents which will be used to plan or report operational test and evaluation.

f. Evaluation procedures for evaluate systems

(1) For Milestone I. A Materiel Acquisition Decision Process (MADP) position consisting of an Early Operational Assessment (EOA) or Abbreviated Operational Assessment (AOA) will be prepared by the operational evaluator. A TEP to guide the evaluation between Milestone (MS) O and MS I will only be required if actual Early User Test and Evaluation (EUTE) is to be conducted during this period.

(2) For Milestone II. A MADP position which consists of a TEP and EOA from any EUTE conducted. Even if EUTE will not be conducted, portions of a TEP will be required for the phase from MS I to MS II to guide evaluation or assessment and to identify data sources used in support of an EOA (e.g., developmental testing, market survey, etc.).

(3) For Milestone III. A MADP position consisting of a TER from initial operational test (IOT) and all other operational testing conducted prior to MS III. Multiple tests such as, IOT, Force Development Test and Experimentation (FDTE), and limited user test (LUT) may be planned in the single TEMP document. For intervening milestones (e.g., MS IIIa) supported by LUT or any other less than full operational test, an operational assessment (OA) will be used to report on operational effectiveness and suitability issues resulting from these tests. If an Initial Operational Test and Evaluation (IOTE) is conducted prior to the Low Rate Initial Production (LRIP) release decision, then a TER will be written to report on the findings of the LRIP.

(4) Beyond Milestone III. For subsequent milestones and materiel release decisions. The Operational Evaluator (OEC, or other OT&E activity) provides a position relative to materiel release to the Materiel Release Board (MRB) consisting of the most recent TER, an OA or AOA. A TER will be mandatory if FOT is conducted equivalent to IOT. An OA will be written if FOT is conducted equivalent to a LUT or FDTE. A TEP will be prepared if FOT or significant other operational testing will be conducted subsequent to MS III. An AOA may be used to update the evaluator's position for subsequent MRB.

(5) Reports. Periodic reports may be rendered on evaluated systems throughout the life cycle. Format for these reports will be the OA/EOA or AOA at the discretion of the evaluator (subject to guidance from Commander, OPTEC or other OT&E activity, or higher authority). Frequency and timing of these reports will be

based on requirements of DOD, HQDA, IPR decision authority, Commander, OPTEC or other OT&E activity.

1-5. The independent operational evaluation (IOE) process

a. Required by DODI 5000.2 and AR 73-1 to:

(1) Assess system operational effectiveness and suitability.

(2) Address readiness to proceed to the next acquisition phase.

(3) Assess the adequacy of testing and identifies the unresolved issues.

(4) Address the need for additional testing.

b. An independent operational evaluation will be conducted on all ACAT I, II and ACAT III and IV designated as oversight systems. (See figure 1-4.) They are planned and conducted by the operational evaluator (OE). The OE must remain independent from the combat developer (CBTDEV) and materiel developer (MATDEV) and report directly to the decision authority.

(1) The evaluation is based on an approved set of critical operational issues and criteria (COIC). COIC are provided by the combat developer for materiel systems or the functional proponent for IMA systems, prior to MS I. These COIC and additional operational issues and criteria (AOIC) are documented in the Test and Evaluation Plan (TEP) prepared by the operational evaluator and operational tester. These are the issues which the test and evaluation must answer to provide information for a production and deployment decision. (See chapter 2, this part.)

(2) Operational evaluations may be identified as, independent evaluation, operational assessment, early operational assessment or abbreviated operational assessments. One system may be subjected to several operational evaluations throughout its life cycle. For example, prior to MSs I and II early operational assessments or operational assessments predominate for ACAT I and II systems. MS III production decisions require an independent operational evaluation for all ACAT I and II systems. Abbreviated operational assessments are written to support milestone decision reviews at any milestone for ACAT III and IV systems. After MS III, the requirement for an independent operational evaluation for ACAT I and II programs will be determined by the scope or impact of changes.

(3) For IMA programs where independent operational evaluation is not conducted during the post deployment software support phase, the tester is responsible for preparing a TEP and performing an assessment of the system change package contents, if such testing is indicated in the TEMP.

c. To ensure that test data are adequate to answer operational issues, the evaluator participates in test planning, conduct, reporting, and reviews prior tests of the system and other data sources identified in the TEP. If previous evaluations have surfaced operational deficiencies, the evaluator determines whether the corrections that have been made are effective. Before every milestone decision review (MDR), the IOE prepares a TER/OA/AOA and provides it to the decision review body. The evaluator uses all available information to prepare the official position for the milestone decision.

1-6. Operational and other user testing conducted in support of the materiel acquisition process

a. General

(1) OT is conducted on materiel systems with typical user troops in as realistic an operational environment as possible. OT uses personnel with the same military skills and training as those who will operate, maintain, and support the system when it is deployed. A realistic operational environment includes tactical operations conducted in accordance with the system's wartime operational mode summary/mission profile (OMS/MP), which specifies the number, type, and frequency of combat operations during a period of time. The scenarios used in OT should use the tactics, doctrine, and logistics and maintenance support concepts planned for use when the system is fielded. The OT threat represents threat systems' capabilities and threat tactics and doctrine postulated at postfielding. The environment for these operations may include:

(a) The employm of opposing forces.

(b) Electronic and other enemy countermeasures.

(c) Simulated nuclear, biological, or NBC chemical warfare.

(d) Smoke and other forms of battlefield obscuration.

(e) Terrain and weather.

(2) Operational testing can provide data not obtainable through other sources (modeling or simulation) or may be used to validate previous analytical efforts. It is required for all development systems, including Nondevelopmental Items (NDI) and Product Improvements (PIs), unless waived or not required by the Test and Evaluation Master Plan (TEMP) or the approved Acquisition Strategy (AS). AR 73-1, chapter 5, discusses operational testing in more detail.

b. Early user test and experimentation (EUTE). EUTE is a generic term encompassing all system tests employing representative user troops during the Demonstration Validation phase prior to MS II. The purpose of EUTE is to test materiel concepts, support training, and logistics and identify interoperability problems and future testing requirements. EUTE provides data for an early operational assessment to support the MS II decision. FDTE and/or CEP may comprise all or part of EUTE.

(1) Early user test (EUT). An EUT is a test prior to MS II conducted with RDTE funds. EUT use procedures described for OT modified as necessary by maturity and availability of test systems and support packages. EUT seeks answers to known issues which must be addressed prior to MS II.

(2) Early user experiment (EUE). An EUE is a field experiment conducted to generate data, which is subsequently used to identify potential systems related solutions, and/or to define issues to be addressed at MS II and beyond.

c. Limited user test (LUT). The LUT is a generic term encompassing all RDTE funded testing, normally conducted between MS II and MS III that is not a part of IOT as defined below. LUT addresses limited operational issues and is used to accomplish the following objectives:

(1) Testing necessary to supplement developmental testing prior to a MS IIIa decision to purchase long lead or LRIP items for IOT.

(2) Testing necessary to verify a fix to a problem discovered in IOT that must be verified prior to the production decision (i.e., problem is of such importance that verification of fix cannot be deferred to FOT).

(3) As needed to support NDI or a Materiel Change (MC) acquisitions that do not require a dedicated phase of IOT prior to a production decision.

(4) A LUT will not be used to circumvent requirements for IOT prior to a production approval decision as prescribed by statute, DOD directives and AR 73-1.

(5) A LUT will not be used to piecemeal IOT through a series of limited objective tests.

d. Initial operational test and evaluation (IOTE). The results of EUTE can be incorporated into IOTE. IOTE for development systems includes all system components, such as hardware, associated support packages, ground support, computer software, training, test measurement and diagnostic equipment (TMDE), and all systems with which the system under test must operate. Waiver requests for IOTE are supported by plans and schedules for obtaining relevant data from other sources and are approved at MDRs. IOTE is characterized by:

(1) Use of production-representative materiel systems.

(2) Organizational units, table(s) of organization and equipment (TOE) units, provisional units, or elements typical of those that will employ and support the system.

(3) Employment under realistic simulated combat conditions equivalent to those expected during the initial operating capability (IOC) timeframe and against the threat postulated for the system's deployment. The threat capabilities are normally representative of these projected for IOC plus 2 years.

e. Follow-on operational test and evaluation (FOTE).

(1) FOTE is conducted after the decision to enter the production and deployment phase. FOTE is conducted to ensure that production items meet operational effectiveness and suitability requirements; to validate corrections to identified system to validate corrections of training and logistical deficiencies; and to resolve issues remaining after the full scale production decision. FOTE is conducted on production items using the IOC unit as a normal part of an acquisition program.

(2) The operational evaluator should minimize the need for FOTE by making maximum use of other data sources. As much as possible, FOTE uses current and complete support packages, organizational structures, doctrine for employment, supportability, threat, communications and control, tactics, training, and interfaces with other systems.

(3) An FOT may be conducted in the same manner and to the same depth as an IOT. An FOT may be conducted for limited objectives in the same manner as an LUT. An FDTE may accomplish the objectives of an FOT. The evaluator tailors the extent of the FOT to the requirements.

1-7. Operational and other user testing conducted in support of the information mission area (IMA) acquisition process

a. Operational testing. Previously called Software or System's Acceptance Test (SAT) or similar tests, will be conducted in a realistic operational environment using troops or assigned civilians from representative units or organizations, and incorporating the approved threat.

b. Supplemental site test (SST), information systems (IS). An SST may be necessary for those systems which execute in multi-hardware and operating system environments. The SST supplements the IOT SAT and its conduct similar to a Lead Site Verification Test (LSVT).

c. Initial operational test (IOT). Testing for a MS III decision is called an IOT. Between MS III and system retirement, testing is called Post Deployment Software Support (PDSS) for IMA systems, and Follow-on Operational Testing (FOT) for materiel systems. LSVT applies only to emergency or urgent date driven changes.

d. Independent evaluation. Major systems (Class I through IV systems (AR 25-3 and figure 1-2) will have an independent operational and developmental evaluation. The assigned independent technical and operational evaluators provide the only official evaluation report.

e. See chapters 5 and 6, Part One for a discussion of incremental acquisition, OT&E, and fielding strategies suitable for IMA systems.

1-8. Operational test and experiments conducted in support of the combat and training development process

a. Force Development Test and Experimentation (FDTE). FDTE is a generic term encompassing a range of tests and experiments conducted with troops under field conditions to support both materiel system acquisition and the development of doctrine, training, organizations, logistics, materiel concepts and/or requirements. In support of materiel acquisition, FDTE may support definition of the materiel requirement or assess the doctrine, training, organization, and logistics developed for the

materiel system. An FDTE also supports the development and approval of concepts and doctrine, training, and organizations not specifically tied to a materiel system acquisition. Although there are no absolute requirements for either FDE or FDT, FDE will normally be more applicable early in the acquisition process when combat and training developers are seeking to solidify and mature the doctrine, training, organization, and logistics aspects of the system. FDTE are funded by TRADOC.

(1) Force development test (FDT). An FDT is conducted to generate data which will be used to evaluate the effectiveness and suitability of doctrine, training, leader development, organizations, and or logistics, either related to a materiel system or a separate development. The major purpose of an FDT is to determine if the product tested meets the stated requirement. Results of the test may also be used to further refine the product (e.g., doctrine or training). An FDT will normally be scheduled later in the process, especially just prior to an IOT or FOT, to ensure these aspects are ready to be included in the operational test of the total system. FDT conducted following the full production decision, using the initial operational capability (IOC) unit, is also appropriate to address open issues subsequent to FOT. FDTs may be funded by either OMA or RDTE.

(2) Force development experiment (FDE). FDEs are conducted to generate data which will be used to identify and refine proposed solutions in the areas of doctrine, training, organizations, logistics, as well as materiel requirements. FDEs are funded by TRADOC.

b. Concept evaluation program (CEP). A CEP is a TRADOC program to provide quick reaction and innovative evaluation to resolve combat and training development issues. The primary focus is on development of a materiel requirement. CEP is RDTE funded, and OPTEC maintains these funds for disbursement at the direction of TRADOC. TRADOC conducts a CEP Schedule and Review Committee (CEPSARC), similar to the TSARC, to approve and prioritize CEP requirements. As with FDTE, planning and execution is patterned after OT&E of materiel systems, with as much scientific rigor as practical. Separate, dedicated tests may be necessary to provide data to support the CEP evaluation. These are called CEP tests to distinguish them from other tests conducted for customers.

c. Customer test (CT). A test conducted by OPTEC for a requesting agency external to OPTEC. The requesting agency coordinates support requirements and provides funds and guidance for the test. These test are not directly responsive to Army program objectives and are not scheduled or approved through the

General Officer Test Schedule and Review Committee (TSARC) process unless external resources are required for test support.

1-9. The relationship of operational testing to developmental testing, contractor testing, and live fire testing

a. OT is normally conducted separate from DT, such as; technical feasibility test (TFT), qualification test (QT), preproduction qualification test (PPQT), production qualification test (PQT), and contractor test. (See AR 73-1.) DT and OT may be combined or conducted concurrently whenever the objectives of both OT and DT can be met and whenever clearly identified, significant cost or time benefits would result. When combining DT and OT care must be taken to ensure a successful DT is not a criterion for a successful OT. Operational evaluation reports are always published independent from developmental evaluation reports. The extent to which DT and OT are either combined or concurrent is addressed while the acquisition strategy is being formulated and is included in the TEMP.

(1) A combined test is a single test using the same materiel and users in support of both the developmental and operational evaluations.

(2) Concurrent testing consists of multiple tests using separate materiel and users and which are conducted at the same time for supporting developmental and operational evaluations.

b. Contractor testing. A contractor test is any test conducted by the materiel development contractor under contract to the materiel developer (Program Manager). These tests are normally conducted prior to materiel acceptance by the PM. Contractor tests are non-government tests integrated into the T&E process through the TEMP to provide data for evaluation purposes.

c. Live fire test and evaluation (LFT&E) results will be integrated into the overall evaluation of designated systems. (See Part VI of this pamphlet.) The objective of LFT&E is to provide a timely and thorough assessment of the vulnerability and/or lethality of a system as it progresses through its development and subsequent production phases.

Category	Authority	Other requirements
ACAT ID	USD(A)	This category represents MDAP and is designated by the USD(A). These programs are materiel systems that require program review by a DAB and approval by USD(A) at each MS. Before the DAB review, Army major systems also undergo review by Army management through the ASARC. Major system programs are initiated by the approval of an MNS and receive the full level of OPTEC evaluation.
ACAT IC	USD(A)	ACAT IC programs are designated by the USD(A). The MS decision authority is the AAE through the ASARC process. The selection criteria is the same as ACAT ID programs and are also "major defense acquisition programs." ACAT IC systems also receive the full level of OPTEC evaluation.
ACAT II	AAE	ACAT II are designated acquisition programs designated by the AAE (AR 70-1) that require program review by ASARC and approval by the AAE at each MS. This category represents "major systems." ACAT II programs are initiated by the combat developers approval of the Mission Need Statement (MNS) (AR 70-1 and AR 71-9), subject to AAE's approval of the requirement document using Acquisition Decision Memorandum (ADM). IOE is normally conducted by OPTEC.
ACAT III	PEO/ MACOM	ACAT III programs are designated by the AAE. The MS decision authority will be the AAE-designated Program Executive Officer (PEO), Major Army Command (MACOM), Major Subordinate Command (MSC) of a MACOM as determined by the AAE, program, project, or product managers (PM). This category represents the previous "nonmajor level I." Programs designated as ACAT III require in-process reviews (IPRs). IPRs are chaired by the PEO.
ACAT IV	MACOM	ACAT IV programs are designated by the AAE and represent all other Army acquisition programs. ACAT IV programs include systems and end items that require intensive management and are managed by a PEO, MACOM, MSC, PM, or any other level deemed appropriate by the AAE. These programs may be used for managing systems that have not been designated ACAT I, II or III.

Figure 1-1. Acquisition categories (materiel systems)

Category	Level	Type	Approval Authority
Class I	$1 billion or $200 million	OPA or RDTE	DAE or DAB
Class II	$100 million or $25 million	Total program cost or 1 year	DOD MAISRC
Class III	$50-$100 million or $15 million	Total program cost or 1 year	Army MAISRC
Class IV	$10-$50 million	Total program cost	Army MAISRC
Class V	$2.5-$10 million	Total program cost	HQDA and MACOM
Class VI	Under $2.5 million	Total program cost	MACOM

Figure 1-2. Acquisition categories (information mission area)

EVALUATE THE OPERATIONAL EFFECTIVENESS AND SUITABILITY OF DEVELOPING SYSTEMS WHEN USED:

- IN A REALISTIC, OPERATIONAL ENVIRONMENT
- IN OPERATIONALLY REALISTIC SCENARIOS
- BY TYPICAL SOLDIERS OR ORGANIZATIONS
- ACCORDING TO APPROVED TACTICS, DOCTRINE, AND OPERATING PROCEDURES

Figure 1-3. OT&E objectives

- STARTS AT MILESTONE 0 AND CONTINUES THROUGH MILESTONE IV
- INTEGRAL PART OF THE ACQUISITION STRATEGY (AS)
- TO MAKE A DIRECT CONTRIBUTION TO THE TIMELY DEVELOPMENT, PRODUCTION, AND FIELDING OF SYSTEMS WHICH MEET THE USER'S REQUIREMENT AND ARE EFFECTIVE, SUITABLE, AND SAFE
- CONTRACTOR, TECHNICAL, AND USER T&E

Figure 1-4. Operational evaluation

Chapter 2
Continuous Independent Operational Evaluation in the Acquisition Process

Section I
Introduction

2-1. Nature of Continuous Evaluation (CE)
CE begins as early as possible in the life cycle of system management. As necessary, CE is conducted throughout the system acquisition process to assess acquisition risks, to evaluate operational effectiveness and suitability, to evaluate logistic and training supportability, and to determine interoperability with NATO and other systems.

2-2. Life cycle testing
Most testing commences with competitive tests to validate design concepts for selection of a system for further development. Tests of selected foreign systems that are viable alternatives are conducted by US or joint U.S./NATO allies throughout the acquisition cycle, as appropriate. When feasible and practical, the tests are conducted with representative prototypes in realistic operating environments. When tests at the overall system level are determined to be infeasible or impractical, competitive prototype tests of critical subsystems are considered in the same manner as described above.

2-3. Need for success in testing
Tests need not be repeated if adequate results are achieved. However, if test results reflect significant deficiencies, the decision review will not permit program advancement into a succeeding phase until those deficiencies have been corrected and, if necessary, the corrections verified in a retest. A deficiency will be considered significant if it would make the system unacceptable for deployment, or if correction involves more than very routine engineering. Included in this definition are major inadequacies in support and test equipment, supply support, transportation and handling, technical data, facilities, and personnel and training (the system support package).

2-4. Conduct of CE
The conduct of CE requires active participation of independent operational evaluators throughout the acquisition process. It requires effective interaction with an exchange of ideas and data with the acquisition community.

Section II
Objectives of CE

2-5. CE integration
Foster the integration of all appropriate test and analysis information in arriving at the assessment of a system's operational effectiveness and suitability.

2-6. CE opportunities
Create opportunities for early operational evaluator involvement in the development and acquisition process in order to avert operational problems as the system matures.

2-7. CE understanding
Enhance the Army's understanding of the system's readiness for operational test.

Section III
Continuous Evaluation Principles

2-8. CE definition
CE is a continuous process extending from concept definition into deployment which evaluates the operational effectiveness and suitability of a system by analysis of all available data. CE is an evaluation methodology for ensuring responsible, timely, and effective evaluations of the status of a system in its progress toward mature system operational effectiveness and suitability. The independent operational evaluator (IOE) is responsible for performing CE on all major and selected nonmajor systems.

2-9. CE background

a. The CE strategy resulted from a series of acquisition decisions which were adversely impacted by the lack of early testing and by the evaluation of immature systems. In these evaluations, the levels of achieved system effectiveness were driven by deficiencies in hardware, software, training, logistics support, and tactics. Because the evaluation strategy did not encourage aggressive early identification and correction of these operational deficiencies, system evaluations in support of production and fielding decisions often reflected lower than required system effectiveness and unsupported predictions of future effectiveness growth. Decision makers had to make their judgments based on these evaluations without the assurance that the system could meet required levels of effectiveness when deficiencies were corrected.

b. The Army needed a more effective evaluation strategy, requiring more active independent evaluator involvement throughout, earlier operational test and experimentation, more effective use of all information and Army analytic resources, and more frequent reporting of findings, conclusions, and status reports. This improved evaluation strategy would help to ensure the identification and correction of deficiencies prior to the formal operational test which supported the production decision. It would also improve the evaluator's ability to quantify the effectiveness of mature systems. As a result, the Army would be less likely to face the potential loss of important systems attributable to immature development or the developer's failure to anticipate problems.

2-10. Scope of CE
CE encompasses a broad analytical approach to the operational evaluation of a materiel acquisition program from earliest concept definition into deployment. CE has evolved to include examination of source selection, Nondevelopmental Item (NDI) market investigations, materiel change, and post-fielding system effectiveness to provide extensive coverage of MAP events. This operational evaluation encompasses the assessment of requirements definition, operational concepts, training requirements, and life cycle support requirements. CE requires the operational evaluator to:

a. Identify events necessary to verify the adequacy of developing system attributes (e.g., mission performance, training, RAM, tactics, software).

b. Cause the early execution of such events before IOT.

c. Monitor the events and assess the adequacy of the system with respect to its attributes.

d. Monitor the corrections applied and assess the adequacy of the corrective actions to be identified deficiencies.

e. Periodically report on the status of the system with respect to its technical and operational attributes.

d. CE thus requires frequent assessments of technical and operational status, as well as reports of that status to the acquisition community and decision makers. Feedback from these assessments will facilitate timely correction of problems and help ensure that a mature system can be operationally tested prior to the scheduled production decision milestone.

2-11. Frequency of reporting

CE requires effective use of all data sources, existing Army resources and expertise, analysis capabilities, modeling capabilities, and instrumentation. CE demands effective exchange of knowledge, expertise, resources, and planning throughout the acquisition community. Thus, it is imperative that the evaluator examine each operational requirement and its justification; examine the causes of problems; assess the operational impact of deficiencies; and, validate the adequacy of corrections applied to identified deficiencies.

2-12. Objective of CE

a. The objective of CE is to provide decision makers, materiel developers, logisticians, trainers, combat developers, and other acquisition team members with continuous assessments of the system's operational effectiveness and suitability throughout the acquisition cycle.

b. Based on multiple data sources, the system assessments are composed of requirements analyses, studies, tactical and logistical modeling, Early User Test and Experimentation (EUTE), contractor tests, Developmental Tests (DT), Force Development Test and Experimentation (FDTE), and Initial Operational Test and Evaluation (IOTE), Follow-on Operational Test and Evaluation (FOTE), and post-fielding Sample Data Collection (SDC). The assessments provide decision makers with a comprehensive assessment of a developing system's ability to meet the stated need in its current state and estimates the potential for a successful, mature configuration.

c. The extension of operational evaluation to include data sources outside the realm of classic DT and OT allows periodic independent evaluation reporting and facilitates a continuous interaction between the MATDEV and the CBTDEV. The operational evaluator serves as a catalyst by reporting operational effectiveness and suitability trends which take into account the maturity of the materiel system and its support concepts.

2-13. Principal CE participants.
The principal CE participants and their basic responsibilities are described as part of the T&E community in Part One of this pamphlet.

2-14. CE process

a. To be effective, operational evaluators must know how to influence the process and at what point and time they should present their positions. They must be knowledgeable about the appropriate source to use when obtaining essential information.

They must also be cognizant of what analyses, studies, tests, and other activities are being planned that can be of value.

b. CE works within the MAP. AR 70-1 and AR 73-1 detail both the traditional MAP and the Army Streamlined Acquisition Process (ASAP). CE requires evaluators to assess issues and criteria, acquisition strategies, test plans, instrumentation plans, threat definition, software development, MANPRINT, Integrated Logistics Support (ILS), training adequacy and many other program elements which can have a significant impact on both the success of the system and the success of the evaluations.

2-15. CE for ACAT III and IV programs
CE for abbreviated evaluate systems. CE for these systems is less extensive, uses fewer resources, and is tailored to the system. The independent operational evaluator (IOE) is responsible for performing CE on all ACAT III and IV systems that are designated for DOT&E oversight. The IOE may also be requested to evaluate Customer Tests, FDTE, and other tests in which the Program Manager or MATDEV seeks the evaluators expertise.

Section IV
OTE Planning Process

2-16. Overview

a. This section details planning processes used to develop the necessary evaluation strategy for effective evaluation of a system and to derive and document system evaluation and test plans.

b. An evaluation strategy provides an overview of the MAP from the evaluator perspective; defines the evaluation support to be provided to the acquisition decision process; and identifies the necessary test, model, simulation, and analytic events needed to support the evaluation process. To develop the evaluation strategy, the evaluator must:

(1) Review requirements documentation and COIC.

(2) Develop additional operational issues and criteria (AOIC) for evaluation.

(3) Identify the data-generating events needed to answer the criteria.

(4) Coordinate with the user and within the acquisition community.

(5) Develop the Operational Test and Evaluation Outline (Part IV) of the TEMP.

2-17. Principles

a. The evaluation strategy is developed in parallel with the AS so that they support each other. The evaluation strategy includes the refinement of the planned evaluation support to be provided to the acquisition decision body, and the refinement of the testing, modeling, simulation, and analytic events necessary to support the specific evaluation.

b. See Section VI, below, on the development of an OTE strategy for Part IV of the TEMP. The TEMP documents the different OTE cycles to be performed during the development and acquisition of the system. The OTE cycle begins with planning to develop a TEP for an operational test. The cycle ends either with an evaluation or assessment and the associated IOE position and briefing to the acquisition decision body.

c. All aspects of operational effectiveness and suitability must be evaluated under anticipated combat conditions or conditions of use. Operational evaluations reflect the system in a realistic environment with typical users, support, and threat personnel and equipment. Credible test and evaluation is highly dependent on how well a realistic operational environment can be duplicated.

d. OTE quality are reflected in the degree to which the final product conforms to established scientific standards. Testing supports good evaluation processes in providing "ground truth" to the summative evaluations that judge if the product improves mission accomplishment. Formative evaluation allows decisions to be structured about product and process evaluation simultaneously.

Section V
Development of a Life Cycle Evaluation Strategy

2-18. Coordinated evaluation development
Development and use of system requirements and of issues and criteria are integral parts of the acquisition process. The evaluator must both make use of and interact with the CBTDEV requirements and COIC processes. In conjunction with COIC and

requirements developed by CBTDEV and TNGDEV, the evaluator develops and uses baseline correlation matrixes (BCM) for tracking requirements. The evaluator ensures that evaluation issues respond both to requirements and to COIC.

2-19. Requirements

a. As the Army CBTDEV for materiel systems, TRADOC develops the requirements for new systems or upgrades to existing systems using the Concepts Based Requirements System (CBRS). Evaluation strategy development begins during the requirements development process to ensure that the system decision milestones are properly supported by OTE events and that system requirements are stated in clear, concise, and, where appropriate, measurable operational terms.

b. Each requirements document generated must be reviewed to develop a sound evaluation strategy and ensure inconsistencies in the specification of requirements are resolved. This review also determines how to best support the strategy and to justify any need for changes to milestones or events.

c. Part One outlines what to look for in requirements documents and how to use the information. The primary requirements documents addressed by the operational evaluator are the Mission Need Statement (MNS), the Operational Requirements Document (ORD), the System Specifications (Specs), and the Request for Proposal (RFP).

d. A parallel process is used for requirements documentation for IMA systems (see Part One for details).

2-20. Critical operational issues and criteria (COIC)

a. The materiel acquisition decision-making process for developmental and NDI systems is based primarily on first analyzing, then evaluating, data associated with the COIC. The COIC are derived from the operational requirement and reflect the minimum essential operational concerns and standards requiring answers during the operational evaluation to make the "Beyond LRIP" (MS III) decision.

b. The approved COIC are used to determine the scope, emphasis, and intensity of the OTE effort. This determination is the basis for the resources (personnel, time, facilities, equipment, instrumentation, and funds) that must be committed to obtain the data to answer the issues and evaluate the degree to which the criteria are met. Detailed guidance for preparation, coordination, and approval of COIC is provided in Part Three.

2-21. OTE cycle
CE is conducted throughout the acquisition process. CE is the mechanism by which the independent evaluator follows a system throughout its life cycle. As the system progresses through the acquisition process, the evaluation matures through plans and reports. Figure 2-1 illustrates how the components of the process follow each other, focusing on the TEMP, EUTE, IOTE, and FOTE. The diagram shows the OTE cycle that occurs for IOTE and FOTE. This cycle of plans, events, reviews, and reports is a major component of the evaluation of operational effectiveness and suitability for a system.

Section VI
Development of an OTE Strategy (Part IV of the TEMP)

2-22. General

a. The IOE is charged with the development of Part IV of the TEMP. Part Two provides detailed guidance on the TEMP to include Part IV.

b. In order to provide evaluator input to the TEMP, the evaluator develops the evaluation strategy (to include pertinent testing) for the system. The evaluation strategy is developed after MS 0 and is continually updated as the system acquisition evolves and the TEMP is revised.

c. FDTE and CEP conducted prior to MS 0 are shown as OT&E to date in the TEMP, but are not a part of the evaluation strategy.

2-23. Evaluation strategies.

a. Full evaluation. Full evaluate systems will require active evaluator involvement in all life cycle events. Full evaluate systems require evaluations and assessments to support all milestones and any other life cycle decisions. The most important of the full evaluate systems require daily evaluator involvement and frequent status reports and reviews. See Chapter 1 for designation of full evaluate systems.

b. Abbreviated evaluation. Abbreviated evaluate systems will require periodic evaluator involvement. Life cycle events will be handled by document review and correspondence. Abbreviated assessments are used to support milestones.

2-24. Testing strategy

When developing the OTE strategy for a system, the evaluator must plan for testing in order of importance. Rather than working sequentially through the life cycle, the evaluator begins with IOT prior to MS III. EUTE prior to MS II, FOT after MS III, and LUT prior to LRIP Release are considered in sequence. The evaluator can then consider any testing prior to MS I and any additional FDTE or CEP which are required by the combat developer.

2-25. ACAT I, ACAT II, and DOTE oversight ACAT III and IV materiel systems (full evaluate systems).

a. These systems are normally high cost, high visibility, technologically advanced, or operationally significant weapons systems. They may possess a combination or all of the above attributes. They will require the highest level of continuous evaluation. They will normally have an extensive series of tests throughout the life cycle.

b. All full evaluate systems should require a dedicated IOT. Only in rare circumstances will a combined DT/IOT be considered appropriate for full evaluate systems. In the development of the evaluation strategy, the evaluator includes an IOT prior to MS III in future testing plans.

c. Depending on the complexity of the system, maturity of the technology, and expressed high level interest, the evaluator judges the requirements for EUTE prior to MS II. Depending on the circumstances, this EUTE may be stand alone, it may be a phase of DT, it may be combined with DT, or it may be a FDTE or CEP conducted in support of the combat developer. The selection of the appropriate level of EUTE is dependent on the issues which must be addressed prior to MS II. These issues need not be part of the COIC, but may be other operational issues or programmatic issues.

d. For the most important systems, FOT is planned from the start. For other systems, FOT is planned contingent on system performance in EUTE and IOT. FOT need not be a full test, but may address only certain issues not answered affirmatively prior to MS III.

e. Systems may require LUT (stand alone or in conjunction with DT) prior to the LRIP Release Decision. This testing is dependent on the characteristics of the system and performance in DT and EUTE.

f. Any operational testing prior to MS I would be in the form of EUE, FDE, or CEP. This is rare and would be planned into the

TEMP only in exceptional cases to address issues which must be answered prior to MS I.

g. The evaluator must work with the combat developer to plan appropriate FDTE and CEP in support of the system. CEP may be run prior to MS I or MS II. FDTE is appropriate before any milestone. FDTE is particularly important prior to the IOT to assure that tactics and doctrine are mature and ready for play in IOT.

h. Given the above considerations, the evaluator designs the OT&E strategy and documents the strategy in Part IV of the TEMP.

i. System modifications (see Part One, chapter 7) to full evaluate systems may be handled as full evaluate OTE or as abbreviated evaluate OTE depending on the extent of the changes and the operational issues engendered by the changes.

2-26. Other ACAT III and IV materiel systems (abbreviated evaluate systems).

a. Abbreviated evaluate (AE) systems do not meet the requirements for full evaluate systems. Evaluation is limited to III at each milestone. They will normally not have an extensive series of tests throughout the life cycle.

b. Some AE require a dedicated IOT. In many cases, a combined DT/IOT might be considered appropriate. In certain instances (NDI), there might be no operational testing required. In the development of the evaluation strategy, the evaluator includes appropriate IOT prior to MS III in the future testing plans.

c. Depending on the complexity of the system and maturity of the technology, the evaluator judges the requirements for EUTE prior to MS II. In most cases, AE systems will have no EUTE. Depending on the circumstances, this EUTE may be stand alone, it may be a phase of [illegible] it may be combined with DT, or it may be a FDTE or CEP conducted in support of the combat developer. The selection of the appropriate level of EUTE is dependent on the issues which must be addressed prior to MS II. These issues need not be part of the COIC, but may be other operational issues or programmatic issues.

d. For AE systems, FOT is planned contingent on performance in IOT. FOT need not be a full test, but may address only certain issues not answered affirmatively prior to MS III.

e. In very rare instances, systems may require LUT (stand alone or in conjunction with DT) prior to the LRIP Release Decision. This testing is dependent on the characteristics of the system and performance in DT and EUTE.

f. AE systems will rarely have any operational testing prior to MS I and planning for such would be an indication that the system should be full evaluate instead of AE.

g. The evaluator must work with the combat developer to plan appropriate FDTE and CEP in support of the system. FDTE is appropriate before any milestone if the cost is justified by the nature of the system.

h. Given the above considerations, the evaluator designs the OT&E strategy and documents the strategy in Part IV of the TEMP.

i. System modifications are handled as shown above for AE systems depending on the extent of the changes and the operational issues engendered by the changes.

j. System modifications (without operational issues) and NDI may not require any operational testing (see Part One, chapters 6 and 7). Market surveys or investigations and DT alone may be sufficient. The evaluator must document this fact in Part IV of the TEMP. Customer tests in a user environment may be conducted on these systems.

2-27. Information Mission Area (IMA)
IMA and other software intensive systems may require a multiple milestone acquisition and OT&E strategy. Guidance on this type of system is provided in Part One, chapter 3 and in Part Seven.

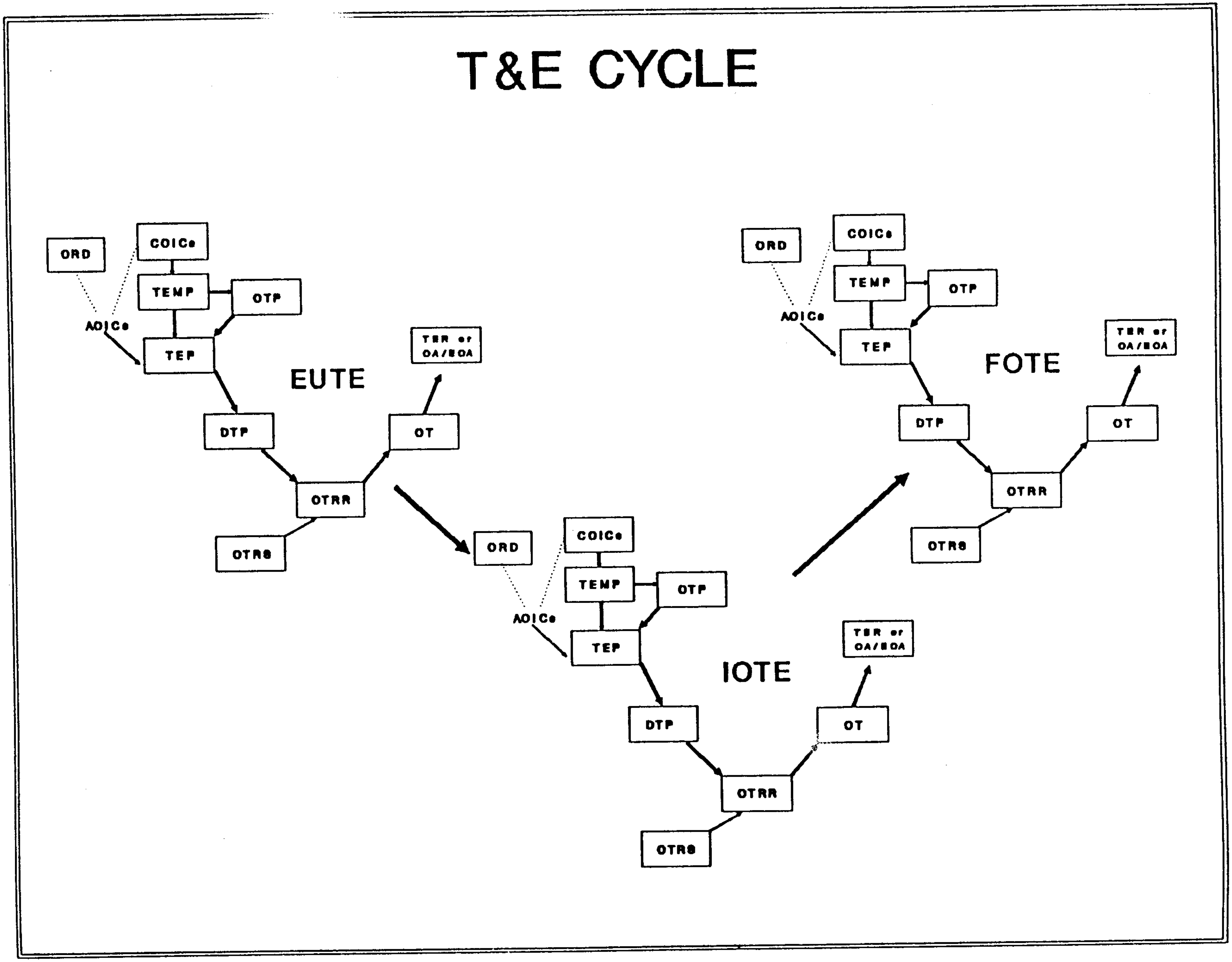


Figure 2-1. T&E cycle

Chapter 3
Operational Test and Evaulation Planning

Section I
Introduction

3-1. Overview
This chapter details planning processes used to develop the necessary evaluation strategy for effective evaluation of a system, to derive system evaluation plans, to design appropriate operational testing, and to document the results.

3-2. Principles

a. All aspects of operational effectiveness and suitability must be evaluated under anticipated combat conditions or conditions of use. Operational evaluations reflect the system in a realistic environment with typical users, support, and threat personnel and equipment. Credible test and evaluation is highly dependent on how well a realistic operational environment can be duplicated.

b. Test and evaluation quality are reflected in the degree to which the final product conforms to established scientific standards. Testing supports good evaluation processes in providing "ground truth" to the summative evaluations that judge if the product improves mission accomplishment. Formative evaluation allows decisions to be structured about product and process evaluation simultaneously.

c. Development and use of system requirements and issues and criteria are integral parts of the acquisition process. The evaluator must make use of and interact with the combat and training developer's requirements and COIC processes. In conjunction with requirements and COIC, the evaluator develops and uses baseline correlation matrixes (BCM) for tracking requirements. The evaluator ensures that evaluation issues respond both to requirements and to COIC.

3-3. Operational test and evaluation cycle

a. IOE is conducted throughout the acquisition process. CE (see chapter 2) is the mechanism by which the independent operational evaluator follows a system throughout its life cycle. As the system progresses through the acquisition process, the evaluation matures through plans and reports.

b. Figure 3-1 illustrates how the components of the process follow each other, focusing on the TEMP, EUTE, IOTE, and FOTE. The diagram shows the OTE cycle that occurs for EUTE, IOTE, and FOTE. This cycle of plans, events, reviews, and reports is a major component of the evaluation of operational effectiveness and suitability for a system.

(INSERT FIGURE 3-1)

Section II
Test and Evaluation Plans (TEP)

3-4. General
The TEP has replaced the previously used independent evaluation plan (IEP) and test design plan (TDP) for the documentation of test requirements and planning results. The abbreviated TEP (ATEP) format used for abbreviated evaluate systems has been incorporated within the TEP and will no longer be used. Implementation of the TEP process has changed many aspects of the preparation of the planning documentation. The magnitude of the changes depend upon the type and management level of the test.

3-5. Level of detail
The degree of detail required for the TEP is increased over that which was required in the TDP. The evaluator and/or test officer must document more details of planning developments and requirements in the TEP. Consequently, the requirements for the DTP have been reduced to match the increase required for the TEP.

3-6. Responsibility for preparation
For the full evaluate level materiel and IMA systems, the TEP is prepared jointly by the evaluator and tester. For abbreviated evaluate (AE) level materiel and IMA systems, the TEP is normally prepared solely by the tester. For FDTE, CEP, and other user tests, the TEP is normally prepared solely by the tester.

3-7. TEP purpose and content

a. The purpose of the TEP is similar for all conditions and provides general information on the materiel or IMA system or nonmateriel requirement description, operational issues and criteria, description of available and required data sources, and a test design consisting of a test concept for those issues and criteria which are to be tested. Additionally, the full evaluate level TEP provides an evaluation strategy and concept for the independent operational evaluation.

b. Specifically, the TEP shows what questions will be addressed and how they will be addressed. For those questions to be addressed through user testing, the TEP defines the amount and type of testing to be conducted, specifies the data to be collected, the factors and conditions that will govern test execution, the required sample sizes, and describes how the test will be conducted. The sophistication, complexity, and depth of the TEP will vary greatly as a function of the complexity of the system.

c. A TEP provides the conditions, range of conditions, event matrixes and data requirements for a user test of the evaluation issues. The tester may determine there are limitations that preclude, completely, or in part, the address of a particular issue in this user test. The evaluator is informed, and the limitation is fully explained in the TEP.

d. The results and products of the planning activities discussed below are the source material for the completion of the TEP.

3-8. TEP format
The general format for the TEP is contained in figure 3-2. As noted above, this format is used for all types of operational tests. The detailed instructions for completion of each paragraph of the TEP format are contained in following paragraphs and figures of this chapter.

(INSERT FIGURE 3-2)

3-9. TEP paragraph responsibilities
The matrix of responsibility for preparation of paragraphs and appendixes of the TEP for each of the general categories of user tests is contained in figure 3-3.

(INSERT FIGURE 3-3)

3-10. Purpose of the TEP (full evaluate systems)
The purpose of the TEP is to document the requirements for a full evaluate materiel or IMA system acquisition program test and evaluation (normally for an EUT, EUE, LUT, IOT, or FOT). Specific purposes of the TEP for the full evaluate level are:

a. To document the evaluation and analysis planning which supports the TER, permitting responsible review and providing continuity when evaluation and test personnel change.

b. To ensure that the operational evaluator and the operational tester cooperate to efficiently and thoroughly plan for the test, analysis, and evaluation to support the TER.

c. To present the test planning necessary that will ensure the test satisfies the purpose and collects the data necessary to address the issues and criteria and support the intended evaluation.

d. To provide the information necessary for the execution of the test.

e. To provide the design and structure of the TER.

3-11. Writing the TEP (full evaluate systems)

a. Preparation of the TEP demands close coordination between the operational evaluator and the operational tester. Chapters 1 and 2 and appendixes A through E, R, and T through X of the full evaluate system TEP are the primary responsibility of the evaluator; chapter 3 and the remaining appendixes are the primary responsibility of the operational tester. Chapters 1 and 2 must be completed prior to completing chapter 3, but is not a "heel-to-toe" process.

b. Draft chapters 1 and 2 must be provided to the tester early in the process to guide development of the draft chapter 3. Finalization of the three chapters results from a cooperative process between the evaluator and tester to identify and resolve problems. TEP preparation must be a team effort between the evaluator and the tester to avoid duplication of effort, to maximize efficiency, and to minimize problems. By working together, the tester is aware, early on, of the evaluator's plan for evaluation and test concept. Likewise, by following the development of chapter 3, the evaluator ensures that the test planning is sufficient to support the evaluation.

c. The milestone requirements for development, processing and staffing, and approval of the TEP are contained in figure 3-4.

(INSERT FIGURE 3-4)

3-12. TEP Coordination and Staffing (full evaluate systems)

a. Informal drafts of chapters and appendixes of the TEP will be coordinated between the evaluator and tester as required and in accordance with the TEP milestone schedule. The purpose of the coordination is to provide early information flow between the

tester, evaluator, and other agencies, as appropriate, on the plans and requirements for the operational evaluation and test.

b. Final draft TEPs will be prepared jointly by the evaluator and tester within OPTEC or other OT&E activity. When the operational tester and evaluator have completed an agreed upon draft, the TEP will be simultaneously staffed within the evaluator and tester activities for concurrence. Other commands will staff in accordance with command-established procedures. The draft TEP will be provided to TIWG members for review and comment.

c. OPTEC distribution lists for both draft and approved full evaluate level TEPs are contained in figure 3-5. Other commands will modify these lists as appropriate.

(INSERT FIGURE 3-5)

d. Comments which identify problems resulting from staffing of the draft TEP will be addressed by the evaluator or tester, as appropriate. A joint test and evaluation working group, chaired by the evaluator, may be conducted to resolve problem areas, incorporate changes, and ensure the final draft fully supports the evaluation and/or test of the system.

e. Coordinating drafts will be staffed in accordance with and in the number of copies required in the staffing list for draft TEPs contained in figure 3-5. Coordinating copies will be distributed by formal memorandum stating the purpose of the staffing, the suspense date for the submission of comments, and the point of contact for questions and coordination.

f. The contents of the coordinating drafts should be concurred with by both the test officer and independent evaluator before staffing. Comments returned as a result of staffing should be incorporated in the final draft or the reason for nonincorporation discussed with the agency submitting the comment.

3-13. TEP approval (full evaluate systems)

a. TEPs for full evaluate level systems originating within OPTEC must be jointly approved by the Commander, TEXCOM and the Commander, OEC prior to release by the Commander, OPTEC. The tester will publish and distribute the approved TEP in accordance with the distribution list for approved TEPs contained in figure 3-5. The distribution list is the minimum required and should be modified to meet any specific distribution requirements.

b. After OPTEC TEP approval for DOTE oversight tests, the TEP will be forwarded, at the appropriate time to the DUSA(OR) for submission to the DOTE for approval of the test concept and test design. DOTE letter of approval will be appended to the approved TEP as appendix T.

c. Approval by commands other than OPTEC will be accomplished in accordance with procedures established by the command.

3-14. Purpose of the TEP (Abbreviated Evaluate Systems)
The purpose of the TEP for other than full evaluate level systems is to document the OT requirements for an abbreviated evaluate materiel or IMA system acquisition program. The specific purposes of the TEP are:

a. To document the planning which supports the preparation of the TER.

b. To present the test planning necessary to ensure that the test will satisfy the purpose and collect the data necessary to answer the issues and criteria.

c. To provide the information necessary for the execution of the test.

d. To provide the methodology for the analysis of the test data and the preparation of results and assessments for the criteria and issues and the overall operational effectiveness and suitability assessment for the system.

3-15. Writing the TEP (abbreviated evaluate systems)
TEXCOM (or other test activity as appropriate) normally prepares the TEP in its entirety. Direct coordination with other agencies are performed as necessary to complete the TEP development. The TEP will include the procedures necessary for the tester to determine conclusions and make assessments for the issues and criteria for the test, as appropriate. The milestone requirements for development, processing and staffing, and approval of the TEP are contained in figure 3-6.

(INSERT FIGURE 3-6)

3-16. TEP coordination and staffing (abbreviated evaluate systems)

a. Within OPTEC, draft TEPs will be prepared by the tester and submitted to TEXCOM for staff coordination and review. Evaluator and user inputs are required for specific paragraphs per figure 3-3. Coordination with other agencies will be in

accordance with figure 3-7. Final draft TEPs will be submitted to Commander, TEXCOM for approval.

(INSERT FIGURE 3-7)

b. Other Army test organizations will follow their internal staffing and approval procedures for TEPs for other than full evaluate level systems.

c. Distribution lists for both draft and approved TEPs are contained in figure 3-7.

3-17. TEP approval (abbreviated evaluate systems)

a. Within OPTEC, the TEP for all other than full evaluate level tests is approved by the Commander, TEXCOM. The tester will publish and distribute the approved TEP in accordance with the distribution list for approved TEPs contained in figure 3-7. The distribution list is the minimum required and should be modified to meet any specific distribution requirements.

b. The approval process for TEPs for other than full evaluate level systems originated by other DA test activities will follow internally developed procedures.

3-18. TEP for other tests
Writing, staffing, coordination and approval of these TEP will follow the same procedures as those used for an abbreviated Evaluate TEP. The purpose of these TEP is to document the test requirements for FDTE, CEP, CT, and other appropriate user test projects. The specific purposes of the TEP are:

a. To document the planning which supports the preparation of the TR.

b. To present the test planning necessary to ensure that the test will satisfy the purpose and collect the data necessary to answer the issues and criteria.

c. To provide the information necessary for the execution of the test.

d. To provide the methodology for the analysis of the test data and the preparation of results and assessments for the criteria and issues.

3-19. Tailoring the TEP for differing OT&E strategies.

The TEP is a multipurpose document and may be used for a variety of purposes than the traditional plan to evaluate and test a system prior to a milestone. These differing purposes include:

a. Development of an evaluation plan where a combined DT/OT will be executed under the auspices of the development tester. In these cases, a separate and independent operational evaluation must be conducted. A skeleton format for a TEP for this purpose is contained in figure 3-8.

(INSERT FIGURE 3-8)

b. Development of an evaluation plan where no user testing will be performed. In these cases a separate and independent operational assessment of the program based on development testing, market surveys, modeling or simulation, or programmatics must be conducted. A skeleton format for a TEP for this purpose is contained in figure 3-9.

(INSERT FIGURE 3-9)

c. Development of an evaluation plan where multiple user tests will be performed in support of the same evaluation and MADP milestone. In these cases a separate test design must be prepared for each test to be performed. A skeleton format for a TEP for this purpose is contained in figure 3-10.

(INSERT FIGURE 3-10)

Section III
Preparation for TEP Writing

3-20. Research methods

The performance of initial research is essential to provide t evaluator and test officer with the background of system developments and the overall requirements that may have to be addressed during the OTE process. The initial emphasis during this period should be to gain familiarity with the system or concept and the personnel interested in the test. Contacts should be made with the MATDEV, CBTDEV, TNGDEV, FORSCOM, and each other. Technical libraries may be used to assist the evaluator and tester in locating any documents from previous or related tests. Participation in SAG and TIWG provide additional opportunities for information gathering.

3-21. TEMP

The TEMP is the basic document for all test and evaluation related to a system and is required for all materiel acquisition system programs and IMA programs. TEMP are not required for FDTE, CEP, or CT requirements which are not a part of an acquisition.

a. TEMP are prepared by the program sponsor with major inputs from operational and technical evaluators and testers. TEMP are approved by DA and DOD (for oversight systems) and by the PEO or MACOM for all others. See Part Two for a detailed discussion of the format, content, and staffing of TEMP. The TEMP provides information in the following areas:

(1) Relates OTE efforts to the critical issues and shows the plan to satisfy the issues.

(2) Defines the T&E schedule and describes T&E for each acquisition phase.

(3) Identifies test support resource deficiencies.

(4) Identifies appropriate milestone thresholds for system requirements.

b. The operational evaluator is responsible for preparing Part Four of the TEMP which also contains the CBTDEV/functional proponent COIC. COIC must be approved prior to incorporation in the TEMP. See Part Five, chapter 2 for discussion of evaluator development of Part Four of the TEMP.

c. The TEMP must be approved prior to initiation of any system testing. No system test may be resourced or initiated unless that test is outlined in an approved TEMP.

d. The TEMP is coordinated with the TIWG members and is the foundation of the TEP. As such, the evaluator and the tester should review the TEMP to ensure that testing is not duplicated and that agreements on testing made as a part of the test integration process are not overlooked.

3-22. Literature search

The evaluator and the tester must be knowledgeable of the system or concept before starting to develop a test design. Whenever possible, they should review all documents related to the test. As a minimum, they should review the results of previous testing and evaluation and the requirements documents. These documents may be obtained through technical libraries, the proponent, or the program manager.

a. TER and TEP of prior tests may provide information on test and evaluation methodology and test design. As a caution, previous plans serve only as a guide since most tests and evaluations require innovative planning, often with unique methodologies. In some cases, the results of earlier testing may partially address the proponent's information needs. This area may include development tests, operational tests, and tests of similar systems or concepts.

b. Requirements documents may provide information not found in the TEP. These documents include the MNS, ORD, and, for older systems, their predecessor documents. Other documents that can be reviewed are the COEA, QQPRI, and ILSP.

3-23. Support packages
The evaluation planner and the test designer must have all or applicable portions of the support packages to properly plan and design the test and prepare a TEP.

a. Support packages are prepared by the MATDEV, CBTDEV, and TNGDEV. MATDEV provide the system support package (SSP) and the new equipment training test support package. CBTDEV provide the doctrinal and organizational test support package and the threat test support package. TNGDEV provide the training support package. The TRADOC proponent is responsible for developing, coordinating, and assembling the CBTDEV and TNGDEV support packages and providing these packages to the tester.

b. Full evaluation of supportability and its impact on operational suitability will be accomplished during the IOTE. In accordance with AR 73-1, all of the TSP must be approved and provided to the tester prior to test initiation. The OTP specifies support packages for test and suspense dates for their submission.

c. A description and discussion of r irements for the support packages are contained in Part O For the user's convenience, summaries of TSP contents ar presented in figure 3-11.

(INSERT FIGURE 3-11)

Section IV
Operational Issues and Criteria (OIC)

3-24. Issues for evaluation

Issues are questions with their associated criteria which are addressed by the evaluator. The issues for evaluation include both the COIC developed by the CBTDEV and the additional issues and criteria (AOIC) developed by the evaluator to complement and supplement the COIC to cover the total system rather than just the critical elements. Issues for evaluation cover all aspects of a system applicable to the OTE of that system.

3-25. Evaluator AOIC
AOIC are developed by the evaluator in coordination with the development of COIC by the combat developer. The AOIC are constructed so the operational effectiveness and suitability will be thoroughly evaluated. AOIC are important to develop and review because they result directly in criteria to be addressed by testing. While the evaluator coordinates AOIC development with the tester, CBTDEV, and other members of the TIWG, the final product is the sole responsibility of the evaluator with no approval or concurrence outside the evaluator's command.

3-26. COIC and AOIC in the TEP
An approved TEP identifies which issues (COIC and AOIC) should be addressed by OT, DT, and by other means, such as modeling and simulation or market surveys and investigations. The evaluator develops AOIC for all TEP for EUTE, LUT, IOT, and FOT. The evaluator also develops AOIC for TEP for full evaluate systems having no OT for the next milestone.

3-27. Technical evaluation issues
A comprehensive set of technical evaluation issues is developed and approved by the independent development evaluator (AMSAA) or development assessor (TECOM) in coordination with the development of the COIC.

3-28. Operational issues for FDTE, CEP, and customer tests
Issues for these tests are developed by the test sponsor (CBTDEV, TNGDEV, or other customer). The sponsor provides OIC to the tester. These issues are not separately categorized as critical or additional.

3-29. Categorization of issues
Operational issues (COIC and AOIC) are questions designed to provide information to a decision maker about operational effectiveness and operational suitability.

a. Questions about the operational effectiveness of a system deal with how well that system will perform what it is intended to do, and whether its performance characteristics contribute to the force mission.

b. Questions about the operational suitability of a system generally address the significance and impact of a system's demands for support to remain operationally effective. It is an important consideration in the decision process to understand, for example, what adjustments must be made in logistical support to service the new system without disruption to service given to existing systems.

c. Both effectiveness and suitability concerns play important roles in the milestone decisions. Even though a system may make significant effectiveness contributions to the force, the skill level required of the operator could be so high that it proves to be an impractical system for fielding.

d. Within the two broad divisions of effectiveness and suitability are the traditional categories for which every question that needs examining can be classified. Strong arguments can be made that any suitability category could also be classified as an effectiveness category. Reliability is certainly a likely case. The breakout given is not intended to serve as a hard and rigid rule. If it serves the purpose, the evaluator may redistribute the categories.

e. Each of the issue categories or performance attributes are discussed to assist in understanding the meaning of the category. The argument can be made that a given issue is as appropriate under any of several categories (Survivability or Mission Performance, for example, can often be used to categorize the same issue). A good rule to remember is that the main purpose for categorizing issues is to give some degree of order to the issues. It simply makes them easier to manage throughout the test planning, execution, and reporting process. The right question must be asked, but not necessarily be put in the right category.

3-30. Mission performance issues
Mission performance issues are those that deal with determining how well the system does what it is designed to do. Such issues normally address the major functions of the system (e.g., detecting, identifying, and engaging aircraft or receiving, processing, and relaying message traffic). They generally address system level functions and do not address component functions.

3-31. Survivability and vulnerability issues
Survivability and vulnerability issues are those that deal with a system's likelihood of avoiding being rendered ineffective by enemy action while a system is performing its mission. The key is "likelihood" since no system has foolproof safeguards.

Operational test measures are normally expressed in of signatures and exposure times. These measures determine ease of enemy engagement. Other operational measures determine the extent of damage, since the enemy engaged the system and because the enemy hit the system. See Part One for a more detailed discussion of Survivability and vulnerability.

3-32. Reliability, availability, and maintainability (RAM) issues

A RAM issue has three components - reliability, availability, and maintainability. These may be broken out into separate issues. See Part One for a more detailed discussion of RAM.

a. Reliability deals with the assurance that a system will not encounter an unacceptable number of failures during operation (frequency of failure), and is generally expressed in terms of "Mean Time between Operational Mission Failure (MTBOMF)."

b. Availability addresses the probability that a system can operate whenever required. It is a measure of usable operating time expressed by percent of total time (availability = uptime/uptime plus downtime).

c. Maintainability deals with the ease of repairing or replacing a system component that failed, the capability for maintenance at the appropriate level, the capability for personnel at these levels to perform diagnostics or maintenance, and the inherent system capability to be maintained. It accounts for the time required to diagnose (fault isolate, detect, and locate), remove, repair, replace, and test for adequacy of correction. Maintainability measures are generally expressed in Mean Time to Repair (MTTR) or restore the system to an operating condition.

3-33. Logistics supportability issues

Logistics supportability issues deal with the impact of providing maintenance and operating support, in both concepts and materiel. See Part One for a more detailed discussion of ILS and logistics supportability.

a. Maintenance support includes repair teams, procedures, the spare parts supply system, and materiel evacuation assets.

b. Operating support must consider such expendable items as POL, air filters, rations and ammunition.

c. Transportability and deployability evaluation issues address the ability to move the system into a theater of operations and move it within the theater of operations

consistent with the mission (these issues are sometimes considered as a separate, distinct element of operational suitability, rather than as a part of logistics supportability). These issues may deal with airplane loading or internal and external helicopter loads. The examination must not only address the ability of aircraft to carry the load, but also their availability (numbers of carrier vehicles not otherwise committed).

3-34. MANPRINT considerations in operational issues
MANPRINT is a concept used to address human performance considerations as they apply to a system. MANPRINT in itself is not an issue, but there are six areas of interest that fall within the concept and are considered in developing operational evaluation issues. The six areas of interest are Manpower, Personnel, Training, Human Factors Engineering, System Safety, and Health Hazards. MANPRINT examines management and technical efforts to assure total system effectiveness by posing the question; "Can typical soldiers, with the training given, perform these tasks to these standards under these conditions using this equipment?" See Part One for a more detailed discussion of MANPRINT.

a. Manpower deals with the number of people in the force structure, irrespective of skill level, required to sustain operations under combat conditions, maintain, and support a system. As such, it seldom has direct connection with the operational evaluation issues for a system.

b. Personnel addresses the ability to provide qualified people for specific skills needed to operate, maintain, and support a system.

c. Training considers time and resources required to develop the correct skill levels.

d. Human Factors Engineering considers the characteristics of people (physical, cultural, mental) that must be addressed in designing a system (known as an ergonomic science, this addresses all aspects of the soldier-machine interface).

e. System Safety considers the safety engineering principles and standards necessary to optimize safety within the bounds of operational effectiveness, time and cost.

f. Health Hazards consider conditions that can cause illness, disability, or reduced job performance.

3-35. Means of employment issues

Means of employment consists of organization, doctrine, and tactics. Organization evaluation issues deal with the manner of the distribution of people by position and of equipment to optimize the system's effectiveness in the context of its operating environment. Such issues also examine the organization of the maintenance and other support units that must interact with the system's unit. Doctrine issues investigate the adequacy of planned doctrine for the employment of the system. These issues must consider doctrinal aspects of the unit or organization that hosts the system, as well as those aspects of supporting and supported units to optimize the effectiveness.

3-36. Interoperability issues

Interoperability issues examine the extent to which a system interacts with or does not interfere with other systems on the battlefield. The system is studied for its synergistic relationship in its operational environment. See Part One for a discussion of interoperability.

3-37. Software considerations in operational issues

Software considerations for battlefield automated systems, except for organization, doctrine and transportability and deployability categories, must be made when forming the issues. Although primarily found in mission performance functions, software extends to the remaining categories. Survivability and vulnerability issues for example, may have a radar warning feature supported by software that warrants examination. Test Measurement and Diagnostic Equipment (TMDE) is likely to be heavily software dependent. Each category should be examined to see if there is reason to include a software issue and criteria. Most software evaluations require some verification of the software's value through testing. See Part Seven for a detailed discussion of software in the T&E process.

Section V
Baseline Correlation Matrixes (BCM)

3-38. Need for a BCM

For a structured approach to reviewing and comparing operational requirements, the evaluator creates a BCM. The evaluator should not wait until the first test is being planned to develop the BCM. The initial BCM should be developed after receipt of the MNS. The evaluator cannot effectively write AOIC until he has developed the BCM. Use of the BCM assures that an evaluator's review of the primary operational requirement documents will uncover inconsistencies to be brought to the attention of the CBTDEV and the MATDEV for resolution. Using the BCM throughout

the CE process makes it possible to eliminate ambiguity and clearly define adequate MOEs that measure the system against the proper requirements.

3-39. Development of the BCM
For some systems the BCM is as simple as a matrix with a column for each requirements document and a row (or series of rows) for each category of operational effectiveness and suitability. For more complex systems, as complex as a loose-leaf binder organized with a section for each category or an automated data base. A BCM is an organized presentation of the operational requirements in all the applicable requirements documents and COIC. In general, the BCM includes the MNS, ORD, and COIC. The BCM does not normally include the system specifications or RFP unless they contain operational requirements. For NDI, the RFP and system specifications may be the primary requirements documents available to the evaluator.

3-40. Sample BCM
A sample BCM is provided in figure 3-12. The operational requirements and COIC are indexed to the individual evaluation issues (far left-hand column) and are traced through the process to the MOEs (far right-hand column) that will be gathered in testing. MOEs are used to ensure that data collected are comprehensive enough to address all the different ways in which a requirement may have been stated.

(INSERT FIGURE 3-12)

3-41. Evolution of the BCM
Developing a BCM is an evolutionary process. For each different requirements document and the COIC, every operational requirement is recorded in its appropriate category with all available and appropriate justification. As the requirements of each new document are added, they are compared to the other requirements in the matrix. By tracing the consistency of the requirements for wording, measures, units, and specific values, discrepancies are found at a time when their impact can easily be minimized. If an inconsistency, omission, or other change that is not directly traceable to an earlier requirement is noted, it must be justified or the inconsistency noted.

3-42. BCM procedures
The evaluation issues and MOE are examined to assure that each and every requirement is covered by a critical or additional issue and by a MOE. The end product is a consistent, fully justified set of operational requirements that is a firm foundation for an evaluation. A discussion of BCM procedures is provided in figure 3-13.

(INSERT FIGURE 3-13)

Section VI
Development of AOIC

3-43. AOIC subject areas
Two types of issues (COIC and AOIC) are used in OTE planning. The evaluator (OPTEC or other OTE command) develops the AOIC using methodologies similar to those used for COIC. (See Part Three.) The evaluator coordinates the AOIC with TIWG members as a part of the TEP (TIWG members comment on, but cannot concur or nonconcur with the TEP). The following components are addressed for each system if applicable:

a. Mission performance.

b. Survivability and vulnerability.

c. RAM.

d. Logistics supportability.

e. MANPRINT (Manpower, Personnel, Training, Human Factors Engineering, System Safety, and Health Hazards).

f. Means of employment (organization, doctrine, tactics).

g. Software.

h. Interoperability.

3-44. Elements of an AOIC set
The elements of an AOIC set are the issue statement, scope, criterion or set of criteria associated with the issue, and rationale for each criterion (with a source to show the origin of the criterion). The conditions for examining and standards for measuring a comprehensive issue are contained in the scope and criteria, respectively. Each element contributes to the cohesiveness of a complete operational evaluation issue. It is re-emphasized that answers to an issue may be provided by one or more means. Therefore, this paragraph discusses the construction of an issue in its entirety, irrespective of the intended data source.

3-45. Issue statements
An issue should be stated in the form of a question for which a response will make a significant contribution to the decision

making process. The issue should be clear, concise, meaningful for the system in question, thought provoking, and broad in nature (the criteria can narrow the focus to a specific path or measure).

a. A well-constructed issue should ask questions such as "if," "whether or not," or "how well" a system performs its major functions, "how likely" it can survive, "how easily" it can be repaired, "whether or not" the logistical support concept can service its ammunition requirements, "how adequate" the training program may be, or "what extent" performance is degraded in an EW environment. There are two basic forms a question can take. One is "if" or "whether or not." The other is "how well," "how easily," or "to what extent."

b. Generally, the "if/whether or not" form is more suitable for a system that is replacing an existing system. It either performs or it does not perform a function. The question is: given that it performs, is it an improvement?

c. "How well/how easily/to what extent" forms of questions are normally more suited to systems for which there is no baseline and the realistic level of expectation cannot be as easily determined.

d. The questions should be designed to encourage freedom in exploring paths of interest that will provide useful operational information to the decision maker. Questions that specify a certain condition (reserved for the criteria) often inhibit opportunities to discover the useful outcomes. The consequence of too narrow an investigation at the outset can lead to a partial, incomplete, or even an irrelevant answer.

e. The question, "Does the machine gun mount have to be removed prior to loading the vehicle on a C130?" is too restrictive. Unless there is an abundance of complementing issues, this issue will probably limit the investigation to only the aspect of on-loading and off-loading clearance. The issue does not allow for other factors that may need to be considered in the airlift deployability area. Further, the issue presupposes that to remove the machine gun mount is a burden.

f. A better question is, "Can the vehicle be strategically and tactically airlifted?" Then, as shown in discussing the scope and criteria, the essential conditions and standards can be established and measured respectively. What the decision maker needs to know is whether the vehicle can be efficiently airlifted to and within the theater of operations consistent with employment.

g. The number of issues should be kept to a manageable level. One must recognize that if a question is important, every opportunity must be made to ensure that it is addressed. The challenge is to determine what is important, and to consider adequately everything without diluting the process. The judicious selection of questions (issues) contributes to meet that challenge.

3-46. Scope statements
The scope enhances the issue by defining the context in which the issue is to be addressed. It provides guidance concerning the conditions and range of conditions necessary for examining the issue.

a. As a minimum, the scope must describe the tasks to be performed and the operational environment in which they are to be measured. A thorough understanding of the mission and concept of employment is essential to assure that the correct circumstances are established. The scope should not specify how the information will be generated, nor what measures shall be made. (The means of generating information are contained in the TEP, and the measures used are reserved for the criterion paragraph.)

b. The challenge in preparing a scope is to enhance the meaning of the issue such that it provides a comprehensive overview of the necessary conditions and serves as a basis for resourcing and sizing any later source of data (e.g., simulations, models, studies, operational testing, and other testing).

3-47. Criteria statements
The criterion associated with an operational issue at a given stage in the system's development is an expression of the level of performance established to measure the accomplishment or the achievement of the issue. Although it reflects an expectation, it should never be viewed as a pass/fail. Instead, it provides a basis for comparison with actual performance in determining the degree of acceptability.

a. A criterion is either stated for a system's functions (the ability to detect, identify and locate a hostile aircraft) or by a system's characteristics (the ability to operate for a given period without a mission failure).

b. There are two types of criteria used to support answering an issue, quantitative and qualitative. The quantitative criterion is preferred since it lends itself to an analysis and more credible description of the actual outcome of the investigation, be it testing, modeling or other. The qualitative

criterion is nonetheless an acceptable approach for circumstances that do not lend themselves to assigning numerical value to the measure (e.g., "there shall be no increase required of personnel or support vehicles to maintain the expanded communication equipment/power supply").

c. There is a tendency to use the term "investigative" for criteria when the user wants to explore the potential of a system's performance or characteristic. Such a practice has a useful application in FDTE and in early user evaluations to determine the parameter's level of performance, but it is not a criterion. "Investigative" means that the user has no requirement or expectation for the measure but would like data upon which to determine a reasonable expectation.

d. A complete criterion statement should always have two elements; a measure (parameter) and a value (threshold). Investigative criteria have no value.

e. A Measure of Effectiveness (MOE) is normally the method for quantifying the criteria. MOEs can be directly observed, calculated from Measures of Performance (MOPs), or derived from military judgment. MOPs contribute directly to MOEs and provide the components for MOE calculation. Sometimes, a third element, confidence level, is appropriate. The measure is the parameter to be examined; for example probability of kill, time to repair, mean time to process a request, message completion rate, percent of targets correctly detected, identified and located, set up/tear down times, degree of degradation (percent of additional unusable messages) in an EW environment.

f. The value is the quantifiable (numerical) expression associated with the measure that is desired or acceptable to the user. (If the measure is expected to improve as development continues, then the value at any given point in time is considered a threshold which represents an intermediate criterion.)

g. A value may be determined by comparing the parameter to the system being replaced, e.g., "The mean time to repair must be no more than that of the ..." or "The P(h) of the weapon must be at least as good as that of the ..."

h. A value also may be established as an absolute value with no relationship to anything else. Such is the case when the parameter to be measured has no corresponding parameter from an existing system.

i. Remember that when the intent is to replace the existing system with a new one, there are tradeoffs to consider. It may be unrealistic to expect every parameter on the new system to outperform the existing system. Often there are many features that can be left unaltered to achieve one or two major improvements. For example, "The effective range of engagement shall be at least 500 meters greater than system 'y' without degradation to Ph or reaction time."

j. It is also conceivable that the new system needs to show no operational improvement over the existing system because the current system was good enough but the new system is significantly cheaper. The confidence level defines the degree of risk or certainty associated with the results.

3-48. Rationale statements
For every evaluation issue, there should be a rationale statement that explains the reason for the choice of the MOE or MOP and criterion values. The rationale serves to force the user (developer of issues and criteria) to consider and justify why the issue and criterion is required or acceptable. Without any supporting rationale, there may be a tendency to develop unrealistic or unnecessary standards. Careful thought must be applied and explained to ensure that the measures and their values are appropriate, realistic, and practical.

Section VII
Documentation of the TEP introduction (chapter 1 of the TEP)

3-49. Preparation of chapter 1 of the TEP
After completion of the above steps, the evaluator documents the introduction to the plan in chapter 1 of the TEP. This chapter of the TEP provides necessary information to understand the bases of both the test and of the evaluation. This chapter may be prepared by either the evaluator or the tester depending on the type of test or evaluation. See figure 3-3 for allocation of responsibilities for the preparation of this chapter. See figure 3-14 for detailed instructions on the writing of this chapter.

3-50. TEP purpose
State the purpose for conducting the evaluation and for planning the testing. State MADP milestones or other decision supported by the evaluation and/or testing and the form and extent of the evaluation or assessment. State the test(s) identified in the system TEMP or other planning document to be designed in the TEP.

3-51. TEP scope

Address the breadth of the data sources to be used to prepare the test and evaluation/assessment reports. Provide an overview of relevant models, analyses, tests, equipment, and other resources which together are the basis for any planned evaluation or assessment. Address the extent to which effectiveness and suitability can and will be evaluated.

a. TEP for Milestone II typically support evaluations of specific system capabilities and potential for maturation. TEP for Milestone III typically support evaluations of operational effectiveness and suitability and the full-scale production decision.

b. When required, TEP for a post-milestone III decision is produced. CBTDEV and TNGDEV may also plan evaluations or assessments in support of their products.

3-52. TEP background
Includes the background of the system development and the test and evaluation of the system. A proper review of the TEMP (paragraph 3-21) should provide adequate information to complete this paragraph.

a. Program background. Include an overview of the program, its acquisition strategy, the system's anticipated use to the Army, and the deficiency identified in the Mission Area Analysis (MAA) that the system is to correct. Identify the next program decision to be supported by the testing and evaluation and the decision to be made (i.e., enter next acquisition phase, low rate initial production, full-scale production, fielding). Identify deficiencies or suitability and effectiveness problems existing in similar systems, as well as the measures used to evaluate those systems, if applicable. For T&E of CBTDEV or TNGDEV products, the background will cover the background of the development of that product.

b. T&E background. Include a summary of all OTE, DTE, contractor testing to date. Include both the scope and the results of the T&E.

c. COEA/OTE relationship. Required for any system for which a COEA is done and OTE is conducted. Describe the linkage between the COEA and the planned results of OTE. The description of the linkage should explain how the MOE and MOP used for OTE are consistent with the criteria in the COEA, which in turn should have MOE and MOP consistent with the ORD, the TEMP and the Acquisition Program Baseline (APB).

3-53. System description

Describe the system (or CBTDEV/TNGDEV product). Describe the major roles, missions, and components or characteristics of the system. Describe similarities and differences between the system under test and the objective system being developed. Summarize the concept for force structure and employment. A proper review of the TEMP (paragraph 3-21) should provide adequate information to complete this paragraph.

3-54. Projected threat
Define the approved threat in the post-IOC timeframe of the tested system. Include capabilities, typical means of operation, and known methods of defeating the system. For ACAT I and ACAT II systems, base the threat on the DA DCSINT approved and DIA validated threat. For Milestone II, state potential targets, countermeasures, and opposing weapons that a single system can expect to encounter on the battlefield. For Milestone III and beyond, describe the threat to the system at battalion level or equivalent. For CBTDEV/TNGDEV products being tested, an appropriate threat statement should be developed. See Part One for a detailed discussion of Threat in T&E.

3-55. T&E milestones
List all milestones important to the success or completion of the T&E leading to a MDR or other event supported by the T&E effort. Include a comprehensive list of all events (study and analysis milestones, model completion dates, document approval milestones, and test events) critical to the overall T&E effort. A proper review of the TEMP (paragraph 3-21) should provide adequate information to complete this paragraph.

3-56. OIC
List the OIC used to evaluate the system, construct an evaluation plan, and develop a test design for the system (or CBTDEV/TNGDEV product). For materiel and IMA systems, OIC will be broken down into COIC (prepared by the CBTDEV/functional proponent IAW Part Three) and AOIC prepared by the evaluator (IAW Section VI). For T&E of CBTDEV or TNGDEV products, OIC developed by the CBTDEV or TNGDEV are required. COIC and AOIC collectively constitute the OIC for the TEP.

3-57. COIC
List the approved COIC directly extracted from the approved TEMP. The COI address key operational questions about a system which must be addressed at each milestone decision. The COI emphasize determination of attainment of certain key performance levels and surfacing potential problems which could jeopardize acquisition. Each COI must have at least one associated criterion. The evaluator may add additional evaluator criteria to a critical issue. Criteria which are a part of the original COIC set will

always have both a measure (parameter) and a threshold (value). Criteria developed by the evaluator may have only a measure.

3-58. AOIC
List evaluator developed AOIC which complement and supplement approved COIC completely addressing all aspects of operational effectiveness and suitability of the system. AOIC address all operational questions about a system which must be addressed for a complete operational evaluation or assessment of the system. AOI emphasize determination of the attainment of all performance levels and surfacing potential problems which could affect the acquisition. The AOIC may change from milestone to milestone as the system evolves and the system requirements are defined. AOIC may or may not have quantitative criteria. Keep the number of issues to a manageable level. Nonetheless, it is necessary to recognize that if a question is important, every opportunity must be made to ensure that it is addressed. The challenge is to determine what is important and to consider adequately everything without diluting the process. Evaluator developed criteria may have only a measure.

3-59. BCM
Call out the BCM in this paragraph and include the actual BCM as a figure or table on a facing page. Only full evaluation TEP require a BCM. Section V contains instructions on preparation of the BCM. The purpose of including the BCM in the TEP is to show the derivation of the AOIC from the other requirements for the system to include the MNS, ORD, FD, system specification, RFP, COIC, and SOTEP. The BCM provides a mapping of the various documented system requirements documents with the COIC and the AOIC. The evaluator uses this structured process to uncover and resolve inconsistencies between the primary requirements documents and the total set of operational issues and criteria.

(INSERT FIGURE 3-14)

Section VIII
OTE Concept Development

3-60. General
The sophistication, complexity, and depth of the evaluation will vary as a function of the complexity of the system. This section provides guidance about methods for development of the evaluation concept written from the perspective of more complicated system evaluations to be as complete and all-encompassing as possible. Significant latitude exists for evaluators to reduce scope and complexity of OTE concepts. For example, the material on the

approach to system evaluation will likely be complex for a major air defense missile system. For an IPR system that is not complicated, however, it may only consist of a statement that system effectiveness will be determined using military judgment based on the soldier's ability to complete task X. When the tester prepares the analytic concept for a TEP of an abbreviated evaluate system or a TEP for FDTE, CEP, or CT, he uses a Pattern of Analysis (POA) to develop measures and data requirements. (See section XVI, below, for POA guidance.)

3-61. System evaluation concept
The TEP basis for evaluation planning is the system evaluation concept, the methodology that will consolidate the results of the individual evaluation issues and criteria already developed into overall conclusions on operational effectiveness and suitability for employment of the system. Four different approaches are presented. Other approaches may also be appropriate.

3-62. Primary Measure of Effectiveness (MOE)
Some systems lend themselves to use of a primary MOE which to a large extent quantifies operational effectiveness of a system which is sensitive to degradation by each and every aspect of effectiveness and suitability. For example, suppose that a communication system to provide divisions with person-to-person communications whether stationary or on the move, over an entire division area, with interrupt if busy, and with call-forwarding capabilities. A primary MOE can be defined which measures number of calls successfully completed on the first try divided by the number of requirements for communication whether attempted or not. The MOE may be degraded by operator error, difficulty of use, RAM, logistics support, MANPRINT, or system performance under a wide variety of conditions. The MOE weighs the impact of RAM, logistics, MANPRINT, etc. by their effect on the system's ability to provide division communications.

3-63. Formal decision analysis
When systems do not lend themselves to use of a primary MOE, and multiple alternatives exist for solving an operational problem (competing systems, new system vs. baseline) and have several competing attributes (criteria or MOPs), formal decision analysis techniques provide a structured way to weigh relevant aspects and quantify the relative worth of the alternatives. Multi-attribute decision models or other standard operations research techniques can be effectively used to rank competing alternatives by overall operational effectiveness and suitability. Examples include "Dominance," "Maximin," "Maximax," Hierarchical Additive Weighting," "Linear Assignment," "ELECTRE," "TOPSIS," and "LINMAP."

3-64. Military judgment
The least formal approach is the use of military judgment. In this approach the evaluator uses his experience to determine, subjectively, the operational effectiveness and suitability of the system. This approach is most appropriate on systems or concepts that have singular or few specific capabilities which have clear thresholds of acceptability. The more complex the system and the more capabilities it provides, the more difficult it is to weigh good and bad attributes of the system by military judgment alone and to develop overall effectiveness assessments.

3-65. Modeling and simulation
Models and simulations are often used to extend OTE results, to explore the impact of deviations from requirements, to show the expected effectiveness of new or enhanced capabilities, or to quantify a system's operational effectiveness and suitability. When a model or simulation is proposed for these purposes, it is to be described in enough detail so the factors played and the methodology used in determining the outcome of the model can be understood. The model logic should support inferences about the growth of soldier-weapon interaction over the life cycle of the weapons system. Models and simulations must be accredited before use in OTE. See Part One for use of modeling and simulation in support of T&E and for accreditation procedures.

3-66. Development of the system evaluation concept
Detail must be developed on proposed analysis methods or analytic considerations that are planned in support of the approaches to system evaluation. The evaluator must address assumptions, limitations, and identified risks associated with the analysis proposed. OTE primarily intended to provide early operational experience on a system, to verify component functionality, or to verify corrections to identified deficiencies need not address all aspects of system operational effectiveness and suitability. T&E limitations must be identified and considered to determine the impact of these limitations on the evaluation. Determine why the limitation exists and what can be done to minimize its impact.

Section IX
Development of MOE and MOP

3-67. Measure of Effectiveness (MOE)
A MOE is a measure that expresses the extent to which a combat system accomplishes or supports a military mission.

3-68. Measure of Performance (MOP)

A MOP is a parameter that expresses the extent to which a combat system accomplishes a specific performance function. In general, higher level MOP are themselves composed of either lower level MOP or data requirements.

3-69. Data requirement (DR)
A DR is a quantitative or qualitative piece of information that is relevant to the determination or categorization of one or more MOPs. A DR can consist of either specific test measures (e.g., start time, velocity, position, type target) or arithmetically combined measures from test (e.g., elapsed time, calculated distance between points a and b, number of rounds fired). A data requirement does not generally involve summary statistics (e.g., mean, median, percent), which are usually considered lower level MOPs.

3-70. Decomposition of operational issues
Evaluators should use a dendritic process for developing logic trees and work breakdown structures for decomposing issues into MOE, MOE into MOP, and MOP into DR. Factors and conditions are integrated and necessary event dendritics are developed to both improve and structure test and evaluation planning.

3-71. Decomposition of criteria
A criterion associated with an issue is an expression of the desired level of accomplishment of the system. A MOE is the quantification of the extent to which a system attains the criterion. The MOE (a higher level measure which is mission-oriented) generally encompasses one or more MOP. MOE may be directly measurable, calculated from MOP, or based on military judgment.

a. For example, in a communications network, a MOE would be the degree to which it supports division command and control. The MOP might be completion rate or availability of RF links.

b. In an example of an air defense system, the MOE may be the degree to which the system provides protection from hostile air attack. The MOP might be the ability to detect or engage.

3-72. Example of decomposition
Operational issues define the relevant questions that must be answered in the evaluation. Answers to these issues come from data generated from many sources, the most important of which is usually the operational test. As a vehicle for discussing the development of MOPs and DRs, an example issue, associated scope and criteria is presented in figure 3-15. The example issue, scope, and criteria represent a typical issue and criteria and are used to illustrate the process used to develop appropriate

MOPs and DRs. The criteria presents two obvious MOPs, and the scope presents considerations relevant to factors and conditions that need to be addressed when answering the issue. Close examination of the issue in figure 3-15 shows many questions not explicitly stated, which need to be answered to understand the ability of the system to locate targets:

(INSERT FIGURE 3-15)

a. What constitutes a target?

b. How will false targets be handled?

c. What constitutes a target presentation?

d. What constitutes a correct detection?

3-73. Evaluation planning questions

After defining terms, questions such as the following, become relevant and the planning methods described in this section help identify these type questions and lead to a more thorough and well structured data base on which to support the evaluation.

a. Are any of the functions accomplished by the system causing deficiencies in the time or accuracy of location?

b. Are there factors or conditions which lead to deficiencies in time or accuracy of location?

c. Are there areas where training or man-machine interface could be modified to improve target location?

d. Are there learning or other trends associated with target location measures?

3-74. Evaluation planning objectives

The primary planning objective is to understand the system response to the environment in terms relevant to the issues and to support quantification of how well the matured system can function. MOEs, MOPs, and DRs emerge as a necessary by-product of this planning. Each of the planning methods discussed leads to more substantive information with which to understand the system response. Mutual application of these planning methods will result in a more credible and useful evaluation because the evaluator plans not only for the estimation of system capability: but, for an understanding of why the capability is as it is and for estimating how that capability might be expected to change as the system matures. The methods suggested also help in the early identification of required instrumentation and data organization.

3-75. Functional dendritics
Evaluations are organized by the identified evaluation issues for the system. Criterion statements associated with the issues typically identify the primary MOE. The evaluator expands and clarifies the primary MOE into a functional dendritic which covers supporting measures of performance and data requirements appropriate to the analysis of the issue.

a. Development of this dendritic structure begins with the evaluator identifying the primary functions that the system performs in executing its mission. These primary functions are broken out into secondary (and sometimes tertiary) functions and into MOP which quantify the performance of those functions. Finally, the MOP are decomposed into the set of data requirements which make up the MOP.

b. For the example issue in figure 3-15, the primary mission of providing prioritized target information is quantified in the criterion statement. The functions that support successful execution of the primary mission include searching the target area, detecting targets in the area searched, identifying and classifying as red or blue the targets detected, prioritizing the identified targets, locating the prioritized targets, and tracking the moving targets which have been located.

c. To search a target area effectively, the system needs to cover the search area and do it efficiently. How does one measure coverage and efficiency? How do inadequacies in searching the target area effect the MOPs? What is special about the system which is relevant to searching that needs to be quantified? What makes a good detection? What are the capabilities of the system that impact or aid in detecting? How does discrimination between true and false targets impact the detection of true targets? How does the success of the search function impact the detection success? How is classification success determined? How is it impacted by the validity of the target? Is efficiency a consideration? What is correct prioritization? How is it measured? How do undetected targets effect prioritization success? Dendritic development encourages this type of questioning, the answers to which strengthen the evaluation planning.

d. As an example, the target location issue is developed following the above logic, into a functional dendritic in figure 3-16. The dendritic breaks the primary mission, providing prioritized target information, into lower level functions, supporting measures of performance and finally into data requirements. Factors and conditions that are likely to impact the measures and are to be varied in test or analysis, are not

included but are discussed in the next paragraph. Each end point consists of measurable data which is traceable to the issue through the dendritic. This approach gives a reviewer an organized way of seeing how the data elements were derived, and promotes understanding of the relationships between measures and data requirements.

(INSERT FIGURE 3-16)

3-76. Factors and conditions
Factors are the test variables identified as likely to affect test event outcome. Conditions are the discrete values that factors assume or are expected to assume. For example, "range at presentation" is often regarded as a factor with the condition values of short (less than 1,500 meters), medium (1,500-2,500 meters), and long (greater than 2,500 meters). Likewise, "scenario" is often regarded as a factor assuming such condition values as "offense," "defense," and "tactical road march." Factors represent independent variables used to characterize test events and are used to categorize, analyze, and evaluate outcomes of test events.

a. Four types of control are typically applied to factors: held constant, systematically varied, tactically varied, or uncontrolled. Personnel, organization, doctrine and tactics, and logistical support are normally held constant. Factors controlled by the tester to define test events are considered systematically varied. For example, because they are controlled by the tester, "offense" and "defense" trials are treated as systematically varied in test though they would vary tactically in actual combat. When not directly controlled by the tester, engagement conditions (such as range, firer velocity, target velocity, target aspect, and electro-optical countermeasures) are considered to be tactically varied. Uncontrolled factors generally include meteorological conditions, system operational status, and player attitudes.

b. The set of factors and conditions influencing a MOP cannot be practically addressed in the functional dendritic structure without quickly creating an unmanageable number of branches. The evaluator must create and use a logical structure to control the combinatoric explosion of factors and conditions that threatens both internal and external validity. Therefore, the evaluator identifies the factors and conditions likely to have meaningful impact on the MOP and organizes them in a separate chart that serves as the basis for identifying situations and combinations of situations to be examined in studies, models, analyses and tests; that provides a framework within which the evaluator can identify the relative frequency of occurrence of operationally

important situations; that reflects a more representative environment by ensuring data from different combinations of situations are obtained in roughly the same proportions as expected in combat or are analytically weighted to give summary measures comparable to combat expectations; and that serves to ensure that both experimental design and analysis planning consider influencing variables in a fitting manner.

c. The factors and conditions chart for evaluation planning is developed without reference to whether its contents are practical to test. In this way the evaluator is most likely to consider the largest set of relevant influences on each particular MOP. Later, in planning for a user test, a more restricted factors and conditions chart can be presented addressing only those factors and conditions to be varied in the test.

d. Figure 3-17 builds on the functional dendritic in figure 3-16 to show how a factors and conditions chart is used to identify additional data requirements. In addition, it shows the utility of the chart for identifying both potential sets of test circumstances and sets of circumstances that might not get exercised in test, but need to be appropriately compensated for by other data sources or addressed through analysis and evaluation.

(INSERT FIGURE 3-17)

e. Based in part on the analysis concept, the evaluator determines the appropriate factors and conditions, together with the associated degree of control, and presents them in the form of a tabular list (usually grouped by type of control). Depending on the extent of free play in each phase of the planned test, the type of control can vary by phase (e.g., systematic control of range and target velocity is normally required in a live-fire phase to satisfy range constraints but not during dry fire as range and target velocity can be allowed more flexibility by controlling only initial trial conditions with operations orders and initial player placement).

f. The tabular list typically requires footnotes with accompanying discussions to clarify how the proposed types of control will ensure that appropriate numbers of events occur under various combinations of test conditions. Figure 3-17 provides a typical listing of factors, types of control, and conditions for a typical scenario.

3-77. Event dendritics
A complementary technique useful for the identification and organization of required data is the use of event dendritics.

Like functional dendritics, event dendritics consist of a hierarchical decomposition of system functions into data required for analysis and evaluation. However, instead of decomposing these functions by MOP relevant to specific issues and criteria, event dendritics decompose these functions by the sequence of "events" performed in the conduct of operational missions.

a. An "event" is an opportunity for the occurrence of an operationally relevant function about which the evaluator or analyst would obtain data. Typical events might be designed for target detections, firings, target passes, movements, handoffs, and recoveries.

b. The execution of functions and subfunctions during the conduct of an operational mission generates a natural hierarchy of events and sub-events (i.e., there may be several target passes within an operational mission, several detections within a target pass and several firings for each detection).

c. The event dendritic starts with the identification of the period during which a particular series of events might occur. The lower levels of this event dendritic will consist of the lowest level actions about which data is operationally relevant. At this lowest event or action level, the evaluator then identifies the set of data relevant to the conduct of the action, which might influence the result, which is necessary to give a full operational description of the event, and which describes when, where, and how well the event was performed. This includes time related actions associated with the accomplishment of the event, circumstances around which the event occurred, environmental conditions that could influence the outcome, operator actions, responses from the system, and system status indicators, any of which might correlate to the system's performance during accomplishment of the particular event.

d. The difference between the event dendritic and the functional dendritic is the orientation; measures of performance versus events. Functional dendritics result in data requirements that support the development of identified performance measures. The event dendritic results in data requirements which describe the conduct of operational missions. Both are required for effective evaluation planning and will benefit later test, analysis, instrumentation and data base planning.

e. Figure 3-18 illustrates an event dendritic for the example issue. It is predicated on the existence of "engagement periods" during operating the system which are recognizable and useful for the organization of data. For this example, an engagement period is defined to begin when a target is within X kilometers and

intervisible for at least Y seconds and to end when either intervisibility is lost for z seconds or the target passes out of range. This event dendritic complements the functional dendritic and the associated factors and conditions chart. The event dendritic results in the identification of specific engagement functions that encompass the subfunctions relevant to detecting, acquiring, and firing on a target within the defined start and stop times.

(INSERT FIGURE 3-18)

3-78. Data requirements planning
The end product of the functional dendritic, the factors and conditions chart, and the event dendritic, is the set of data needed for a comprehensive system evaluation. Each of the three approaches will likely need expansion based on the results of the other two. Their completion is an iterative process, and the products produced form the foundation for the evaluation. The perspectives of each approach differ and, as the examples show, determine a complementary but different set of data requirements. Without question, these examples can be expanded to include data requirements, MOPs, and factors not shown. The examples show, however, the thought process and the products that lead to a comprehensive set of data requirements and an associated data base which supports an effective evaluation. The functional dendritic and the factors and conditions chart contribute to the analysis planning. The factors and conditions chart forms the foundation for experimental design development, and the event dendritic forms a natural organization for the data.

3-79. MOP dendritic
Figure 3-19 provides a generic dendritic for MOP. It breaks mission performance into six major functions (target location, mobility, firepower, C3, computation, and productivity), one or more of which may be appropriate to any particular system. Figure 3-19 suggests only one of the many possible organizations for performance oriented functions and is presented as a possible starting point for mission performance planning. Use of the functions and the associated MOPs presented in the example will require augmentation and adaptation for each system. For example, a sensor system might have as its primary system MOP, the percentage of real targets accurately located in a 30-minute scenario. The same quantity might be a lower level MOP for a multi-function combat system which requires not only target location, but weapon system function and quick displacement to be effective.

(INSERT FIGURE 3-19)

Section X
Evaluation and Analysis of MOE and MOP

3-80. Use of MOP
A MOP measures the degree a system accomplishes a specific function. In general, a MOP may be composed of lower level MOPs or data requirements. Each MOP can be categorized as an Operational Test MOP (OTMOP), a Modeling MOP (MMOP), or a Development Test MOP (DTMOP) to describe the source of data. The operational tester will only address the OTMOPs in OT. The others serve to describe how the evaluator will fill data voids from sources other than operational test.

3-81. Issue resolution
The evaluator must develop the logical process which he intends to use to resolve the issue. He decides how the data from the identified sources will be integrated and how anticipated constraints on the realism or the completeness of the data will be treated. He develops the steps used to interpret analyses; how and where modeling, simulation, or military judgment will be used; and, when appropriate, how conclusions on individual criterion will be integrated to resolve the issue. The evaluator determines the comparisons that are anticipated and the estimates that will be made and ascertains their utility to the evaluation.

3-82. Evaluation strategies
More than one strategy can be used to address different aspects of an issue, and occasionally it can be appropriate to use more than one strategy to address the same aspect. Discussion of each aspect of an issue is to include factors, conditions, and operational scenarios appropriate to the evaluator's plan to investigate discrimination between the systems, organizations, methods of operation, or procedures. Three basic comparative evaluation strategies are typically used.

a. Comparison of new or competing system capability to the corresponding capability in the system being replaced (e.g., baseline).

b. Comparison of new or competing system to a predetermined standard.

c. Comparison of an organization's capability with and without new system.

3-83. Analysis approach
An analysis approach is the framework within which data for all the MOPs will be analyzed. The evaluator identifies analytical

steps planned to explore and understand the data, integrate data from appropriate sources, summarize or re-express the data, estimate parameters, and determine trends or otherwise explore the data in a manner relevant to the evaluation of the data set.

3-84. Analysis concept
The analysis concept is the anticipated framework within which data for the issue will be analyzed. With it, the evaluator identifies the analytical steps planned to explore and understand the data, integrates data from appropriate sources, summarizes or re-expresses the data, estimates parameters, and determines trends or otherwise explores the data in a manner relevant to the evaluation of the data set or issue. The evaluator identifies how judgmental criteria and weights will be applied in the analysis and identifies anticipated graphical or arithmetical techniques and the degree to which the analysis will be exploratory (i.e., finding out what the data are trying to say) rather than confirmatory (i.e., using formal statistical inference to answer predetermined questions).

a. A good analysis concept serves as a "road map" for the analyses which are intended to identify or support evaluative conclusions. Like any road map, it is not meant to be rigidly followed if the actual data or other circumstances lead to a better procedure. The use of decision support system tools is an aid in developing the analysis concept.

b. The evaluator identifies the specific techniques appropriate for making the comparisons or estimates called for in the analysis concept. For each comparison or estimate, the chosen technique must be planned in sufficient detail to establish a sound analytic treatment for the operational question being asked. Alternative techniques are sometimes appropriate, but no attempt should be made to perform each and every alternative form of analysis.

3-85. Data assumptions
After the test, actual data often render even the best planned techniques irrelevant or inappropriate. The evaluator should identify the assumptions associated with the data, the distributions, and the use of proposed analysis techniques. The extent to which the results are likely to be sensitive to deviations from the assumptions, especially as they impact calculations of planned confidence intervals and significance statements should be addressed in planning.

3-86. Data independence
The independence of data points must be preserved. The many factors which typically influence the utility or character of a

data set must be controlled. The evaluator should identify known constraints on the use of data in support of the evaluation and plan to handle the constraints as required. Examples of constraints are: data from a model which does not play realistic hostile or friendly air defense, data obtained from a single environment, data from immature software, logistics data limited to realistic maintenance below direct support, and data from crews that have not been cross-trained. The evaluator includes a discussion of whether the constraints will be handled judgmentally or with formal analysis (specify technique), and clarifies the extent to which the impact of constraints is likely to be remedied.

3-87. Data displays

The evaluator proposes the data displays, tables, figures, or other forms of presentation appropriate for displaying data, analyses, or results of analyses in reports.

Section XI
Planning for Evaluation Data

3-88. Data sources for OTE

While the OT (EUT, EUE, LUT, IOT, or FOT) is normally the primary source of data for the operational evaluation, the evaluator must consider all sources of data available. This assures that all data are considered in the evaluation and prevents duplication of effort in the scoping of the OT. If the user test duplicates other efforts, there is a waste of resources. The evaluator must look at all sources available and list these in his plan.

a. Possible data sources other than the user test include--

(1) Other user test being conducted (FDTE, CEP, CT)

(2) Development testing (DT).

(3) Contractor testing.

(4) Modeling (to include the COEA modeling).

(5) Simulations.

(6) Market surveys and investigations.

(7) Other studies and analyses.

b. All sources of data to be used in an evaluation or assessment must be described in the TEP.

(1) An OT listed as a primary or secondary data source for any MOP must be described in a test approach paragraph. The OT to be planned in the TEP must have the evaluator test approach and concept clearly thought out. The test approach varies in scope and complexity depending on the size and sophistication of the anticipated OT. The test approach provides the basis for test design and for the detailed test plan. Derivation of a test approach is discussed in detail in Section XII, below.

(2) Other sources of data are investigated by the evaluator to determine the variety, range, and quality of data to be anticipated. The evaluator must coordinate with the personnel responsible for each listed data source in the planning phase to ensure availability of required data.

(3) User tests (other than those OT described in above), DT, and contractor tests will be described in sufficient detail to provide understanding of the test. Models, simulations, market surveys and investigations, studies, and analyses will be described in sufficient detail to permit both understanding of the effort and the value and context of the data derived from the source.

3-89. Development of the data source matrix (DSM)
All sources of data to be used in an evaluation or assessment must be described in the TEP. A DSM is prepared.

a. Each MOE or MOP must be addressed by at least a primary data source. A primary data source is that source expected to provide all the essential data to answer the measure. Some measures may require data elements from more than one source (i.e., OT data might have to be combined with live-fire data to compute the measure). In these cases, both data sources are considered primary. A secondary data source provides data to be used to supplement primary data, as a contingency against failure of the primary source, and to provide additional verification of the primary data source.

b. Any test, model, simulation, market survey/investigation, study, or analysis listed as a data source (primary or secondary) for any MOP must be identified by the evaluator and described.

c. The evaluator delineates how each data element will be utilized in the evaluation. The evaluator must coordinate with the personnel responsible for each listed data source in the planning phase to ensure availability of required data.

d. The DSM is the matrix of the sources for data to be used in the evaluation (for example, tests, models, analyses, and studies) matched to the issues, criteria, and MOE/MOP which each supports. A sample DSM is shown in figure 3-20. The DSM shows the contribution of each data source to the issue and to each MOP.

e. The matrix cells are to be filled with "P" or "S" to indicate whether the data source will provide a "primary" or "secondary" contribution to the evaluation. Matrix cells are left blank for data sources which are neither primary or secondary. Each MOP must have at least a primary data source.

f. Based on the requirements of the DSM for data, the evaluator can scope the size of the test and the extent of evaluator initiated modelling and simulation. The evaluator also can assure himself that every MOE/MOP will be answered.

(INSERT FIGURE 3-20)

Section XII
Derivation of the User Test Approach

3-90. The operational test design concept (OTDC)
The OTDC varies in scope and complexity depending on the level of sophistication of the anticipated test. It provides a basis for the test design in the TEP (where details of the test design are documented) and for the Detailed Test Plan (where the mechanisms for carrying out the TEP are specified). The OTDC requires enough detail to ensure that a test designed IAW the concept will provide the data necessary to answer the evaluation issues. In addition, it requires enough flexibility to permit evolution as test planning progresses and graceful degradation in the presence of unplanned test delays or shortfal The OTDC identifies the following:

a. The types of tactical scenarios to be conducted, the degree of operational realism (to include threat portrayal) required to answer the evaluation issues, and the types of test events about which data are required.

b. A list of the factors and conditions likely to effect outcomes of test events, and an approach for controlling test factors to ensure that various types of events occur under appropriate combinations of test conditions.

c. A framework for grouping combinations of test conditions into trials, vignettes, missions, and phases for test conduct and an assessment of the sample sizes required to control the risks associated with anticipated analyses.

3-91. OTMOP
OTMOP form the basis for the OT and the test design in the TEP. The OT objective is to answer the OTMOP derived from OIC. Based on the OIC in paragraph 2.2 of the TEP and the DSM, the evaluator identifies OTMOP. OTMOP deal with questions best answered in OT and which cannot be adequately answered by DT, contractor test, modeling, simulations, studies or other data sources.

3-92. The scope of OT
The scope identifies the types of test scenarios and test events that must answer the test issues. The level of detail includes the approximate length of various test scenarios; the number of test items to be exercised in each; the type and size of player, support, and threat units; and the test environment for maneuver area, terrain, vegetation, and security required. Additional details to be specified in this paragraph concern the degree of operational realism required.

3-93. OT simulation of actual combat
The degree of operational realism required depends on the types of scenarios, types of test events, and combinations of test conditions required to answer test issues.

a. The most realistic simulations occur in two-sided battles supported by Real Time Casualty Assessment (RTCA). In such simulations, the events of primary interest are engagements between pairs of players. Initial battle conditions are determined before the start of each test trial. RTCA is used to shape the test battle by encouraging sequences of individual engagement conditions representative of combat under the specified initial conditions. Thus, initial trial conditions are systematically varied but individual engagement conditions develop tactically and cannot be guaranteed. Such testing is expensive and time consuming due to the elaborate instrumentation and instrumentation checkout requirements, and the necessity for ensuring player uncertainty on both sides of the simulated battle.

b. Important cost savings and increases in test efficiency are possible if less realism is acceptable. Often field training or command post exercises are appropriate for testing a system or concept. In these cases, the duration of the exercise should be adequate to address issues such as continuity of operations or soldier stress and fatigue, when appropriate to the evaluation.

c. In some cases, realism is required for only one side of the engagements. The other side can be played according to a pre-planned script. For example, if the primary test issue involves platoon engagement capability against certain threat presentations, carefully scripted threat presentations to a tactically deployed platoon produce a more precise answer than a series of two-sided RTCA engagements. In this case, only threat presentations to the platoon need be realistic. Under some such circumstances, combinations of analytic modeling with one sided operational testing can produce more extensive and believable results with less expense than by testing alone.

d. In other cases, realism about simulation of combat itself is of lesser importance. Testing of centralized systems involved with intelligence gathering, communications, or disruption of communications generally requires realism primarily in the electronic environment. Although emplacements, displacements, and simulated field conditions are required, realistic operational stress on both man and machine is due primarily to types, numbers, and timing of messages or digital traffic. Factors and conditions to be manipulated primarily involve message content, timing, link lengths or system configuration (number of nodes, nets, and paths). Although many personnel (possibly augmented by computer driven simulators) may be required to generate a realistic electronic environment representative of combat, it will seldom be necessary to have large numbers of real people and equipment involved in simulated combat.

3-94. Test factors and conditions

Factors are the test variables identified as likely to effect test event outcome. Conditions are the discrete values that factors assume or are expected to assume. For example, "range at presentation" is often regarded as a factor with the condition values of short (<1500 m), medium (1500-2500 m), and long (>2500 m). Likewise, "scenario" is often regarded as a factor assuming the condition values "offense," "defense," and "tactical road march."

a. Factors represent variables used to characterize test events and are used to categorize, analyze, and evaluate outcomes of test events. Four types of control are typically applied to factors: fixed, systematically varied, tactically varied, or uncontrolled. Personnel, organization, doctrine and tactics, and logistics support are normally "fixed" (or "held constant"). Factors controlled by the tester to define test events are considered to be systematically varied. For example, because they are controlled by the tester, "offense" and "defense" trials are treated as systematically varied in test though they would

vary tactically in actual combat. When not directly controlled by the tester, engagement conditions (e.g., range, firer velocity, target velocity, target aspect, electro-optical countermeasures) are considered to be tactically varied. Uncontrolled factors generally include meteorological conditions, system operational status and player attitude.

b. Based in part on the analysis concept, the evaluator determines the appropriate factors and conditions, together with the associated degree of control, and presents them in the form of a tabular list (usually grouped by type of control). Depending on the extent of free play in each phase of the planned test, the type of control can vary by phase. For example, systematic control of range and target velocity is normally required in a live-fire phase to satisfy range constraints, but not in a dry fire field exercise. During dry fire, range and target velocity can be allowed more flexibility by controlling only initial trial conditions with operations orders and initial player placement. The tabular list typically requires footnotes with accompanying discussions to clarify how the proposed types of control will ensure that appropriate numbers of events occur under various combinations of test conditions.

3-95. Test design matrix(es)
The evaluator controls the risk associated with anticipated analyses by identifying the number of valid events to be conducted under specific combinations of test conditions and by identifying the considerations (e.g., order, pairing) about the conduct of those events to support anticipated analyses.

a. The development of sound interval estimation techniques is critical. The decision the evaluator will make is a decision about the truth or falsity of a pre-designed statistical hypotheses. Lack of detailed planning in this part of the test concept may lead to inferring no statistically significant difference was demonstrated by the test when a difference actually exists.

b. Once the required types of test events and scenarios have been identified in the scope and appropriate factors and conditions have been formulated, the evaluator develops a framework for grouping combinations of test conditions into "trials" and/or "missions" and/or "phases." He determines how many test events of each type are likely to occur in each type trial or mission and how many trials or missions are possible during the available test days or weeks.

c. On this basis, he estimates for tests of various lengths and for alternative formulations of test elements, the aggregate

sample sizes likely to occur under each combination of factors and conditions. Often the aggregate sample size is determined by the time period and number of systems available for test. In this case, statistical procedures can only be used to estimate the risks involved with alternative allocations of resources.

d. When there is more flexibility in scenario duration, number of trial repetitions, number of systems, and other resources available for test, more rigorous statistical procedures can be used to determine sample sizes that will reduce the risks to specified levels. Once sample sizes are determined, they are tabulated as matrixes showing numbers of valid test events to be conducted under various combinations of test conditions.

3-96. Sample sizes in OT
The analyst must balance the requirements for statistical significance in each of the cells of his matrixes with the requirements that the system follows the OMS/MP in test.

a. Rigorous statistical sample sizing can only be done precisely when two conditions are satisfied. First, only a few combinations of test conditions can be involved. Second, a good estimate of test variability must be available for the MOP under consideration. When these considerations are met, simple models based on binomial, normal or other common distributions are used to determine the minimum sample size requirements. NOTE: The text Experimental Statistics by M. G. Natrella (originally printed as a series of pamphlets by AMC) is a good reference for such sample sizing techniques.

b. Before performing statistical sample sizing, answers to the following questions are required:

(1) Is the observed value for the OTMOP to be compared to a prescribed value or to another observed value? Determine whether the comparison value is assumed to be measured without error or is a value from observations of a baseline or alternative which is itself subject to measurement error because comparisons to observed values require larger sample sizes.

(2) Is the comparison one- or two-sided? Examples of one-sided comparison outcomes are: "significantly larger than prescribed value" versus "not significantly larger than prescribed value," or "significantly less than the baseline" versus "not significantly less than the baseline." Examples of two-sided comparison outcomes are: "significantly larger than prescribed value" versus "significantly smaller than prescribed value" versus "not significantly different from the prescribed

value," or "significantly less than the baseline" versus "significantly more than the baseline" versus "not significantly different from the baseline." Two-sided comparisons require larger sample sizes.

(3) How large must the difference between the tested item and the prescribed or observed value be before detecting that the difference is significant? Detecting smaller differences requires larger sample sizes.

(4) What risks are tolerable? Two risk levels require specification. One risk level corresponds to a failure to detect a difference when an important difference really exists. The other risk level corresponds to declaring that a difference exists when it does not. Smaller levels of acceptable risk require larger sample sizes.

c. OT rarely satisfies the two conditions necessary for precise sample sizing because operational testing typically involves many combinations of test conditions and estimates of OTMOP variability during test are vague at best.

d. Data to compute several OTMOPs with different variability are obtained simultaneously. Acceptable or desired performance requirements often vary as test conditions vary, but allowable limits to this variation are seldom specified. The magnitude of differences which are important to detect is seldom specified precisely. Nevertheless, statistical sample sizing is an essential part of operational test planning. Estimates from sample size calculations (even when underlying statistical assumptions are violated) can provide rough assessments of differences likely to be detected in operational test at the associated risk levels.

e. When OT requirements are complicated, application of more sophisticated statistical considerations can clarify impacts of trade-offs between various test design alternatives in sample size and risk levels. These considerations deal with statistical design and analysis of experiments, the branch of statistics which studies techniques for extracting the maximum amount of information from an "experiment."

f. Since most research in the area of sample sizes has dealt with "experimentation," which is much more structured than operational testing, caution is required when applying notions from experimental design to the design of operational tests. However, some application of experimental design is useful for efficient operational test planning. The use of quasi-experimental design and analysis for field settings may be

considered useful by the evaluator. The use of non-parametric statistics may be appropriate for some operational test samples.

g. Simple experimental design notions come into play because alternatives in test element formulation and test length cannot be compared solely on the basis of sample size. Variability in OTMOPs to be used in performing comparisons is also of crucial importance. For a given sample size, experimental design techniques can reduce variability in the comparisons of greatest interest, by increasing similarity of test conditions (e.g., by using paired comparisons or blocking), or by carefully controlling differences between test conditions (e.g., by using Latin Squares or other fractional factorial designs).

h. In addition to addressing variability, notions from experimental design are necessary to address possible bias and confounding, as well as feasibility of obtaining specified sample sizes. Potential bias or confounding occurs when possibly influential factors (either controlled factors or uncontrolled nuisance factors) are not evenly applied. Experimental design techniques can minimize or adjust for such confounding and establish what combinations of sample sizes are mathematically possible using a specified design framework.

i. Because of the frequency with which instrumentation or operational circumstances cause loss of data, caution is recommended in the use of exotic experimental designs which rely heavily on balance or exact numbers of valid samples.

j. The experimental design techniques that have proven to be most successful involve designing in small "blocks" so that test events to be compared occur close together in time or space. The simplest such designs are paired comparisons involving "side-by-side" tests of a candidate and a baseline. More elaborate designs involve testing several candidates under somewhat different conditions at nearly the same time or nearly the same place and rotating candidates and conditions through appropriate locations and combinations of conditions over a period of days or weeks.

k. Such techniques can be used to build up a test design on a day-by-day or week-by-week basis so added cells complement existing cells rather than attempting to replicate them. Each group of added cells not only examines additional combinations of conditions but reduces overall potential for confounding. Designs constructed in this incremental manner not only fit naturally with realities of test conduct but also permit systematic assessment of alternative allocations of test time.

Section XIII
Evaluation Data Base

3-97. Known data support requirements
The evaluator needs to identify known instrumentation and data processing requirements that are not immediately obtainable off-the-shelf. The focus here is to list any specialized instrumentation or instrumentation interfaces, simulators, computer hardware or software that the evaluation planning process has identified as likely to be necessary for capturing and analyzing required data. The evaluator identifies whether there is a requirement for a Data Authentication Group (DAG). Additional information on the DAG is provided in chapter 5.

3-98. Requirements for the evaluation data base
The evaluator must develop and document a test data base file structure that will enable him to analyze test data in a thorough and timely manner, and to integrate it with data from other sources. Known data elements need to be organized according to this file structure and definitions of data elements need to be provided. The evaluator data base may contain up to level seven data. The test data base will usually contain level three data and will not contain data above level 4. See figure 3-21 for definitions and examples of levels of data.

(INSERT FIGURE 3-21)

a. Evaluator specification of data base structure and content must ensure that data base descriptions of test events are sufficient to permit flexible, thorough, and timely analyses even where events occur which may be unanticipated. Organizing test data elements according to what is being described (e.g., test events, sub-event, test items, weather events) usually provides the most effective file structure for flexible and timely analysis. The event dendritic approach discussed above will result in such a data structure. Figure 3-22 provides a typical data base structure. The level of detail in the figure is suitable for a TEP. With appropriate arrows added, the diagram in figure 3-22 describes relationships between files.

(INSERT FIGURE 3-22)

b. The TEP description of the test data base must include identification of the required files to include specification of the files required, and labelling each file with a short description of the type of data to be stored in that file, and an indication for each file whether it is to be automated.

c. The TEP must provide a description of relationships between required files using hierarchical or network diagrams and identification of key elements (e.g., trial number, item identification, date, time, crew number) that are common to several files that define the relationships between files. NOTE: It is usually important to relate MANPRINT data to appropriate effectiveness and suitability data.

d. The TEP must define data elements in each file providing a list of known data elements defined to preclude any ambiguity or misunderstanding on the part of the tester.

e. Figure 3-23 provides an example of a data base record structure. The level of detail is suitable for a file description in an TEP.

(INSERT FIGURE 3-23)

f. The data base structure to be provided later in chapter 3 of the TEP expands that in chapter 2 by adding files or data elements necessary for test control or data quality control, or by refining existing files and data requirements considering evolving test planning.

Section XIV
Documentation of the TEP Evaluation Plan (TEP Chapter 2)

3-99. Preparation of chapter 2 of the TEP

After completion of the above steps, the evaluator documents his evaluation planning in chapter 2 of the TEP. Chapter 2 is the Evaluation Plan. Chapter 2 is prepared by either the evaluator or the tester depending on the type of test or evaluation. See figure 3-3 for allocation of responsibilities for the preparation of this chapter. If the apter is prepared by the evaluator, it is called the Evaluation n. If the chapter is prepared by the tester, it is called the alysis Plan. Paragraph side headings will use the evaluation terminology if prepared by the evaluator and analysis terminology if prepared by the tester. When the tester prepares an analysis plan in this chapter, the effort is simplified and abbreviated.

a. In this chapter of the plan, the evaluator (or tester) presents the methodology by which results of testing and other data sources will address the individual OIC in chapter 1 of the TEP and be consolidated into overall conclusions or predictions on the operational effectiveness and suitability for employment of the system being evaluated. Details are to be given on

b. Aggregation of operational suitability shows the methodology by which the answers to the issue questions will be further analyzed and consolidated to permit conclusions or predictions/assessments to be drawn on the overall operational suitability of the system.

3-101. Operational issues
This paragraph lists in turn each of the operational issues and associated criteria stated in chapter 1 of the TEP. Each subparagraph will contain an issue statement taken in turn from the issue statements in chapter 1. The issues are stated in the form of a question for which a response will make a significant contribution to the decision making process. Scope and rationale need not be restated here as they are already provided in chapter 1 and restatement would be unnecessary duplication.

a. Operational effectiveness issues deal with the overall degree of mission accomplishment when the system is used by representative personnel in the environment planned or expected for its operational employment considering organization, doctrine, tactics, survivability, vulnerability, and threat (including countermeasures, nuclear, and chemical or biological threats). The "system" includes the hardware (to include GFE), software, personnel, and operating and support procedures.

b. Operational suitability issues address the degree to which a system can be satisfactorily placed in field use with consideration given to RAM, compatibility and interoperability, transportability, wartime usage rates, safety and human factors, manpower requirements, logistics supportability, documentation, and training requirements. Important considerations include, for example, the understanding of what adjustments must be made in logistical support to service the new system without disrupting service given to existing systems; whether existing soldier skills, characteristics, IQ, etc. are adequate to successfully employ and maintain the new system; or whether new skills and talents are needed.

3-102. Operational criteria
Each issue subparagraph is further divided into sub-subparagraphs for each criterion statement taken in turn from the criteria statements for the issues in chapter 1. Criteria which were a part of the original COIC set will always have both a measure (parameter) and a threshold (value). Criteria developed by the evaluator may have only a measure. In those cases where the evaluator criterion lacks a threshold (value), the criterion will be labeled "investigative" and only the measure (parameter) specified.

3-103. MOE/MOP
Each criterion sub-subparagraph is further divided into sub-sub-subparagraphs for each MOE or MOP derived to measure a criterion. Each criterion must have one or more MOE/MOP. When the tester prepares chapter 2, there will normally be only MOP. Evaluators may find it necessary to use both MOE and MOP. This paragraph must define the individual MOE/MOP. A MOP expresses the extent to which a combat system accomplishes a specific function. In the DSM, each MOP is categorized as an OTMOP, a modeling MOP (MMOP), or a DTMOP) to describe the source of data. The tester will only address the OTMOPs in the test design. The others serve to describe how the evaluator will fill data voids from sources other than operational test. Sections IX and X and Section XVI detail derivation of MOP. Planned treatment of each MOE or MOP will be described as follows:

a. The analytic design is a description of the logical process to be used to measure the MOE or MOP. The MOE and MOP may be grouped by like analytic designs. The analyst describes how the data from the identified sources will be integrated and how anticipated constraints on the realism or the completeness of the data will be treated. He describes the steps that will be used to interpret analyses; how and where modeling, simulation, or military judgment will be used; and, when appropriate, how conclusions will be integrated to resolve the measure. The analyst specifies the comparisons, or designs, that will be the basis of the analysis and the estimates that will be made and describes the utility of the comparisons and estimates to the analysis. Three basic comparison strategies are typically used comparison of the new or competing system capability to the corresponding capability in the system being replaced (baseline), comparison of the new or competing system to a predetermined standard, or comparison of a military organization's capability with and without the new system. Additional information is gained by looking at the performance of the new system under different conditions (e.g., day vs. night). Discussion of the analytic design for the measure is to include factors, conditions, and operational scenarios appropriate to the analyst's plan to investigate discrimination between the systems, organizations, methods of operation, or procedures.

b. Analytic procedures are a description of the anticipated framework within which the data will be analyzed. This section serves as a "road map" for the analyses which are intended to identify or support evaluative conclusions. Parametric and nonparametric techniques should be specified, assumptions should be discussed, and statistical software packages should be specified. Group the MOE and MOP by like analysis concepts. For each comparison or estimate, discuss chosen techniques in

sufficient detail to establish that there is a sound analytic treatment for the measure. Limited discussion of alternative techniques is sometimes appropriate, but no attempt is made to provide an exhaustive list or comprehensive discussion of alternatives. The actual data often render even the best planned techniques irrelevant or inappropriate. The analyst:

(1) Identifies the analytical steps planned to explore and understand the data, integrate data from appropriate sources, summarize or re-express the data, estimate parameters, and determine trends or otherwise explore the data in a manner relevant to the evaluation of the data set.

(2) Identifies how judgmental criteria and weights will be applied in the analysis.

(3) Identifies anticipated graphical or arithmetical techniques and the degree to which the analysis will be exploratory (finding out what the data are trying to say) rather than confirmatory (using formal statistical inference to answer predetermined questions).

(4) Identifies the specific techniques appropriate for making the comparisons or estimates identified in the evaluation concept.

(5) Identifies the assumptions associated with the data, the distributions, and the use of proposed analysis techniques.

(6) Discusses the extent to which the results are likely to be sensitive to deviations from these assumptions, especially as they impact calculations of planned confidence intervals and significance statements.

(7) Discusses how the independence of data points will be preserved and how the many factors which typically influence the utility or character of a data set will be controlled.

(8) Identifies known constraints on the use of data in support of the evaluation and discusses how the constraints are to be handled. (Examples of constraints are as follows: data from a model which does not play relevant hostile or friendly air defense, data obtained from a single environment, data from immature software, logistics data limited to realistic maintenance below direct support, and data from crews which have not been cross-trained.)

(9) Includes a discussion of whether the constraints will be handled judgmentally or through the use of formal analysis (specify technique).

(10) Clarifies the extent to which the impact of constraints is likely to be remedied.

c. The analyst proposes data displays, tables, figures, or other forms of presentation appropriate for displaying data in reports. Tables must be provided for cell counts, percentages, measures of central tendency or variability, and for ANOVA tables. Group MOE/MOP by like presentations.

3-104. Analytic summaries
At the end of the listing of MOE/MOP for each criterion, describe the logical process which the analyst intends to use to resolve the criterion. Group the MOE and MOP by like analytic designs and concepts and describe how the data from the MOE and MOP sources will be integrated and how anticipated constraints on the realism or completeness of the data will be treated. At the end of the listing of criteria for each issue, describe the logical process which the analyst intends to use to resolve the issue. Group analyses by like analytic designs and concepts and describe how the data from the criterion summaries will be integrated and how anticipated constraints on the realism or completeness of the data will be treated. Describe the steps that will be used to interpret analyses. Describe how and where modeling, simulation, or military judgment will be used. Comparisons are made to baseline, to criteria, and between or among conditions. Describe any planned statistical procedures or analyses that were not given in the planning for the individual MOE/MOP and which will be used to combine or roll up two or more measures associated with this criterion. Include a discussion of any planned comparisons or statistical testing. (See Section X for details.)

3-105. DSM
All sources of data to be used in an evaluation or assessment must be described in the TEP. A DSM is prepared for the TEP. Each MOE or MOP must be addressed by at least a primary data source. Any test, model, simulation, or market survey or investigation listed as a primary or secondary data source for any MOP must be described in chapter 2. Section XI provides details on the development of a DSM. This paragraph is only required for a full evaluation TEP. Abbreviated evaluations use only data obtained from test described in chapter 3.

3-106. OT approach
Use this paragraph to describe an OT for which the evaluator has derived the test approach and concept and whose test design is

described in chapter 3 and beyond. Section XII provides detailed instructions for this derivation. This paragraph is only required for a full evaluation TEP. Abbreviated evaluations derive the test approach in chapter 3.

a. All sources of data to be used in an evaluation or assessment must be described in the TEP. A user test listed in the DSM as a primary or secondary data source for any MOP must be described in a user test approach paragraph. The user test to be described in chapter 3 of the TEP requires a complete description of the evaluator's test approach and concept in this paragraph.

b. This paragraph varies in scope and complexity depending on the sophistication of the anticipated operational test. It provides the basis for chapter 3, Test Design (where details of the test design are documented) and ultimately for the detailed test plan. Elements of this paragraph include test scope, factors and conditions, test design matrixes, and sample sizes.

3-107. Test scope
The scope identifies the types of test scenarios and test events that are required to address the operational test MOPs (OTMOPs). The level of detail includes the approximate length of various test scenarios; the number of test items to be exercised in each, the type and size of player and support units, and the test environment (in terms of maneuver area, terrain, vegetation, threat, and security). The degree of operational realism required in the test must be described. Operational testing simulates actual combat. Thus, the degree of operational realism required depends on the types of scenarios, types of test events, and combinations of test conditions required to answer the OTMOPs. (See paragraph 3-92.)

3-108. Factors and conditions
Factors are the test variables identified as likely to affect test event outcome. Conditions are the discrete values that factors assume or are expected to assume. (See paragraph 3-94.)

3-109. Test design matrixes
Once the required types of test events and scenarios have been identified in the scope and appropriate factors and conditions have been formulated, the evaluator develops matrix(ces) needed for grouping combinations of test conditions into "trials," "missions," or "phases." Matrixes are formed by crossing factors and conditions with one another. Large matrixes should be reduced to several smaller ones. Normally the analytic designs described above will reflect these matrixes. The evaluator determines how many test events of each type are likely to occur in each type trial or mission and how many trials or missions are

possible during the available test days or weeks. (See paragraph 3-95.)

3-110. Sample sizes
The evaluator must control the risk associated with anticipated analyses. He identifies the number of valid events to be conducted under specific combinations of test conditions. He identifies the considerations (such as order and pairing) with respect to the conduct of those events. These procedures are needed to support anticipated analyses. Based on the test design matrix(ces), the evaluator estimates the aggregate sample sizes likely to occur under each combination of factors and conditions for tests of various lengths and for alternative formulations of test elements. Often the aggregate sample size is determined by the time period and number of systems available for the test. In this case, statistical procedures can only be used to estimate the risks involved with alternative allocations of resources. When there is more flexibility in terms of scenario duration, number of trial repetitions, number of systems, and other resources available for testing, more rigorous statistical procedures can be used to determine sample sizes which will reduce the risks to specified levels. Once sample sizes are determined, they are tabulated as matrixes showing numbers of valid test events to be conducted under various combinations of test conditions. The capability of existing or proposed new instrumentation to collect valid data in a cost effective manner is another test design consideration. (See paragraph 3-96.)

3-111. DAG requirements
The evaluator identifies whether or not there are requirements for a DAG. This paragraph outlines the role of the DAG in data validation and in engineering analysis of test data. Details of the DAG procedures are covered in chapter 5.

3-112. Other sources of data
All sources of data to be used in an evaluation or assessment must be described in the TEP. In the DSM each MOE/MOP must be addressed by at least a primary data source. Any test, model, simulation, market survey, market investigation, study, or analysis listed as a primary or secondary data source for any MOE/MOP must be described in this paragraph. User tests (other than those designed in this TEP, contractor tests, and DT will be described in sufficient detail to provide understanding of the test. Modeling, simulation, market surveys and investigations, studies, and analyses will be described in sufficient detail to permit understanding of the effort.

3-113. Data base structure

The evaluator describes a data base file structure that will enable him to analyze test data in a thorough and timely manner and to integrate it with data from other sources. He organizes known data elements according to this file structure and provides definitions of data requirements where appropriate. Evaluator specification of data base structure and content is required to ensure that data base descriptions of test events are sufficient to permit flexible, thorough, and timely analyses. (See Section XIII for details.)

a. Specify files required and label each with a short description of the type of data to be stored in each file. Indicates for each file whether it is to be automated.

b. Describe the architecture used to organize the data base. The architecture typically consists of either a network or relational design for data storage. The network approach may not be appropriate for operational evaluation applications because only data previously related, by defined associations, can be processed. The relational approach organizes data into arrays of rows and columns. Only the types of data need to be specified; the potential relationships between data are implicitly represented. This approach permits the rapid generation of a new file, by combining across two or more types of data.

c. For each file, list known data elements and provide sufficient definitions to preclude ambiguity and misunderstanding.

3-114. Evaluation limitations

This paragraph states known limitations of the evaluation and those data sources (to include the operational test) which support the evaluation. These limitations are to be presented and discussed in terms of the impact of the limitations. This will include an explanation of why the limitations exist, which COIC are impacted, and what can be done to minimize their impact.

Section XV
Introduction to Test Design

3-115. Test design phase

The test design phase consists of the completion of planning for the test design and provides the source material for the preparation of chapter 3 of the TEP for full evaluate systems or the preparation of chapters 2 and 3 of the TEP for all other types of tests.

a. Evaluation planning for OTE of full evaluate systems is performed IAW Section IV through Section XIV, above. These sections provide methodology on development of chapter 2 (Evaluation Plan) by the IOE in the full evaluate TEP.

b. Analytic planning for OTE of abbreviated evaluate systems and for tests of CBTDEV or TNGDEV products is abbreviated into an Analysis Plan and is performed as a part of the test design process. See Section XVI on the development of the POA by the tester. Development of the POA permits the tester to write chapter 2 (Analysis Plan) IAW Section XIV, above.

c. The test design phase is distinctly separated from the detailed test planning phase so that the logical design can be reviewed, changed if necessary, and approved before heavy investments in time and resources are applied to implementation.

3-116. Test design requirements
The test officer must be constantly aware of the requirements for the specific type of test assigned. He must ensure appropriate requirements for the specific type of test are addressed. The extent of preparation required for the TEP is dependent upon the level of evaluation for the test.

a. If the system is a full evaluate level system, chapters 1 and 2 of the TEP will be completed and provided to the tester by the evaluator based on the methodology established in Section IV through XIV, above. Specific guidance on the test description, test design concept, data requirements, and data base structure will have been provided to the tester in chapter 2 of the TEP. This guidance will assist the tester in developing chapter 3 of the TEP.

b. For Abbreviated Evaluate (AE) system tests, the tester will perform many of the evaluation requirements in addition to the tester requirements and will complete both chapter 2 and chapter 3 of the TEP. For these systems, evaluator guidance is limited to providing issues and criteria for the test.

c. For FDTE, CEP, and CT tests, the tester will have to perform all of the evaluation requirements. The evaluator will normally have no input to these tests unless they are being used in lieu of EUTE, LUT, or FOT. The tester must complete both chapter 2 and chapter 3 of the TEP. For these systems, guidance on issues and criteria for the test is provided by the test requestor (normally the CBTDEV or TNGDEV).

3-117. Test design purpose

The purpose of the test design is to provide the logical foundation for the test. It can most logically be developed in the sequence outlined in this chapter. Through a process of analyzing each issue, the needed data are identified. Methods for turning the data into results are stated in detail. The list of test events which must occur is derived from the data elements (DE). In addition to this logical core, the design can contain methodology and procedures for test execution and reduction, analysis, and reporting of test data.

Section XVI
Pattern of Analysis (POA)

3-118. Requirements for a POA
A POA will be developed for all tests. For full evaluate systems, the POA translates the evaluator developed OTMOP into DR. For other tests, the POA translates evaluator, CBTDEV, or TNGDEV developed OIC into tester developed OTMOP and DR.

3-119. Development of the POA
The analysis of issues is the detailed refinement of test issues into questions, ending with data requirements. It should be developed as the first step in a formal test design and is required for all tests. It basically consists of establishing a POA. The POA is a tool that helps the test officer determine what data needs to be collected in order to answer the issue. All other elements of the design are dependent upon the quality of the analysis. This section provides guidance to the test officer when preparing a POA.

3-120. Definitions for the POA

a. An issue is answered either by a finding or an assessment.

b. A finding is a result which is limited to fact and is based on objective and subjective data. There are two types of findings.

(1) The first type includes results of computations or other mechanical operations performed on the data. Calculation of summary statistics or compilation of user comments would be findings of this type.

(2) The second type consists of the results of preset procedures being applied to the data; i.e., procedures which have been preestablished prior to starting the test. An example is a

preplanned test of a statistical hypothesis or establishment of some minimum acceptable performance score for a test item.

c. An assessment is an interpretation of objective and subjective data and/or findings based on the test officer's military judgment.

(1) The difference between assessments and findings of the second type is somewhat confusing at first sight. The key difference is preset procedures. If the application of judgment is precisely written into the appropriate plan and then approved as part of the plan, the result is a finding. If, however, the judgment is applied by the test officer after the test begins, the result is an assessment.

(2) An assessment must be supported by all available evidence. The believability of an assessment is directly related to the amount and quality of the evidence upon which it is based.

3-121. Rationale and method of analysis
Although test issues may seem detailed from the MATDEV, CBTDEV, or TNGDEV points of view, they are very general from the tester's point of view. Consider the issue, "What is the comparative effectiveness of weapons systems A and B?" A test officer could not immediately determine from the issue what tasks he should have the weapons perform, what data he should collect on the performance, or how data should be analyzed to make a comparison. A partial answer to the problem is to divide the issue into several simpler questions which, when answered, will provide sufficient information to fulfill the parent issue. Inherent in this division process is the knowledge of the independent and dependent test variables that were developed during the preliminary analysis phase. The subdivision process continues through as many levels of subquestions as are necessary to establish DEs.

3-122. Methods of subdivision
The process of subdivision is an extension of the process of identification and categorization of variables which was begun during the preliminary analysis and planning phase. At that time, the relationship of the variables was tentative and not established in detail. Development of the analysis of issues makes the relationship of the variables rigorous and precise. The only requirement in each subdivision step is that the subordinate questions be sufficient, as a group, to answer the parent question. There is no limit to the number of ways of subdividing questions. However, the two ways most frequently used are division by situations and division by component attributes. Other specific methods may be appropriate for

particular tests. These methods involve division by MOP's or division by qualitative subquestions.

3-123. Subdivision by situations
Division by situations provides separate consideration of a question or issue under various pertinent sets of conditions. These sets of conditions correspond to identified treatments (independent variables). For instance, the issue "How well do the proposed scout platoons perform compared to the standard scout platoons?" could be divided into three subissues, each directed toward one of the major scout mission types (figure 3-25). Further divisions could be based on the doctrinal subdivisions of each mission type, time of day or night, or any other situational basis the test officer considers appropriate for focusing his analysis.

(INSERT FIGURE 3-25)

3-124. Subdivision by component attributes
Division by component attributes is used to identify qualities or characteristics of the item or concept which need to be known to answer a parent question. These attributes either lead to or are identical to the pertinent dependent variables. For instance, the question "What are the logistics implications of weapons system A?" might be broken into subquestions addressing the attributes of supply, maintenance, and transportation as shown in figure 3-26.

(INSERT FIGURE 3-26)

3-125. Subdivision by MOP
Whatever the method of subdivision, the ultimate goal is to link general questions to simple measurable data elements. The key to establishing this link, within the process of subdivision, is the identification of each MOP. MOPs are subquestions in the division process which can be answered in numerical terms and which represent identified dependent variables by which the item or concept will be judged. They provide the bridge between qualitative subquestions from above and Des below.

a. Consider the qualitative subquestion "Was weapons system A maintainable?" If the responsible test officer feels that further division in qualitative terms is unnecessary, he identifies the MOP which become the next lower level of subquestions. Possible MOPs for this example are shown in figure 3-27.

(INSERT FIGURE 3-27)

b. Further subdivision of the MOP is not usually difficult. In most cases, the next step is identification of summary data, followed by identification of Des. Completion of this process for the above example is shown in figures 3-28, 3-29, and 3-30.

(INSERT FIGURE 3-28)

(INSERT FIGURE 3-29)

(INSERT FIGURE 3-30)

3-126. Subdivision by qualitative subquestions
Not all dependent variables can be expressed in the MOP format. Some are qualitative in nature. For example, the subquestion "Were organizational communications personnel able to erect the antenna without difficulty?" might be subdivided into some subquestions requiring quantifiable data and some requiring only comments or personnel responses. Such a breakdown is shown in figure 3-31. The first two subquestions are MOPs. The third subquestion calls for a consolidation of qualitative data. NONQUANTIFIABLE DATA IS JUST AS IMPORTANT TO THE TEST AS NUMERICAL DATA. Both varieties should be exploited to the fullest.

(INSERT FIGURE 3-31)

3-127. Documentation of the POA
The final product of the subdivision process is the POA which contains all the issues and their subordinate subdivisions. The relationship between issues, questions, and the various levels of subquestions is indicated by the numbering system used in the figures.

a. If issue 3 of any test had three questions, they would be numbered 3.1, 3.2, and 3.3. Further subdivisions of any question are numbered by adding a decimal point and consecutive integers to the number of the parent subquestion.

b. The POA can be set up in two different formats. For the TEP, the format will have to be as shown in figure 3-32. As a working document, the format can be set up as a dendritic tree--the branching lines forming subdivisions resembling the branches of a tree (figure 3-33). In either format, subquestions are labeled only with their appropriate number.

(INSERT FIGURE 3-32)

(INSERT FIGURE 3-33)

c. The only exceptions are subquestions which are also Des. These subquestions are labeled with the letters DE in addition to the number. This prefix signifies that no further subdivision of that question will be performed.

d. The process of subdivision contains as many steps as necessary. There is no limitation. The number of subdivisions will almost certainly vary from one issue to another. The only requirement is that at the end of each branch, there be a DE.

e. When two or more branches are subdivided in identical ways, redundant publication is unnecessary. After the first branch is developed, the others require only a reference to the first.

3-128. Use of the POA
The POA is the backbone of the test. If the test officer has any doubts during POA development, he should work the POA with the supporting analyst assigned for the test. Upon completion, the POA should be closely reviewed within the test organization to ensure that it is complete, unbiased, and logically structured. Careful review and revision at this point will save much wasted effort in the remainder of test design.

3-129. Modifications to the POA
It must be recognized that regardless of the amount of effort and review that a POA receives, it will probably require some modification as the planning process continues. To facilitate modification and review, a wallboard format for the POA is generally preferable to producing and reproducing a typed dendritic outline. The primary value of the POA lies in its value as a planning tool.

Section XVII
Derivation of the Test Design

3-130. Decomposition of OIC
OIC are stated in chapter 1 of the TEP. Chapter 2 of the TEP decomposes these OIC into MOP. Chapter 3 of the TEP takes those MOP designated as OTMOP (all of the MOP for test of AE systems, FDTE, CEP, and CT) and derives the test design.

3-131. Derivation of data requirements (DR)
Associated DR and resultant test factors and conditions are specified in chapter 2 or 3 of the TEP, as appropriate. For full evaluate systems, the evaluator identifies data needed to support the planned evaluation and indicates those that are required from

test. The test designer includes these DR and derives additional DR needed for test control, diagnosis of problems, interpretation of the data, and quality assurance (e.g. the tester typically adds the DR necessary to track system utilization in accordance with the OMS/MP).

3-132. Initial planning for data collection
Specific instrumentation is identified to collect the data required, including relevant constraints on its use. In cases where the primary means of data collection is uncertain of success, a backup means of data collection is included. To ensure that a proper audit trail has been developed, the test designer lists each DR, the instrumentation or other means of data collection, and the degree of data accuracy and precision required.

3-133. Definition of the test structure
The structure of an operational test is driven by sample size requirements and resource limitations and differs as a function of its complexity. Tests can be made up of a training phase, pilot test, several scenario-driven test phases, and special exercises or excursions. The test designer defines the test structure and for each element, specifies what is to be included and how it is to be accomplished. Based on the OT concept, the test designer describes the phases, scenarios, trials, and test events to be executed and defines objectives for each.

3-134. Tradeoffs in test design
The trade-off between practicalities of test conduct and analytic interpretability of results is a primary concern as the tester organizes test events into test trials and test trials into scenarios and phases. Fewer data points collected under the right circumstances can provide more information than many data points collected under less desirable conditions.

3-135. Design for factors and conditions
A key consideration is frequency of required systematic changes in test conditions. Some systematically varied test factors are easier to change in the field than others.

a. Fewer changes in systematically controlled factors enhance efficiency of test conduct. Fixing a combination of controlled test conditions and conducting a number of trials before changing the combination of controlled test conditions is the easiest way to test. Such an approach has drawbacks both for operational realism (especially player uncertainty) and for analytic interpretability (confounded factors and spurious or inflated claims of statistical significance).

b. Frequently changes in systematically controlled factors enhance analytic interpretability. If every combination of test conditions occurs in every trial or in trials conducted close together, analysis is easier. Such an approach is seldom operationally realistic or feasible.

c. The tester compromises between efficiency of test conduct and analytic interpretability by considering the ease with which test conditions can be manipulated. Those conditions that are relatively easy to change are varied for trial to trial (or even within trials). Test conditions that are hard to change are varied over longer periods (e.g. daily, weekly). The tester builds a test design which is both feasible to conduct and likely to yield analytically interpretable results.

d. Statistically, such an approach yields a "blocked" design. Through knowledgeable application of this statistical design approach, the tester can ensure systematic manipulation of many factors in an operationally realistic manner and encourage an appropriate degree of player uncertainty over extended test periods.

Section XVIII
Analysis of Test Requirements

3-136. Tester role
For full evaluate systems, the analysis of the test requirements is performed by the evaluator. For tests of AE systems, FDTE, CEP, and CT, the tester must decompose issues into OTMOP and DR.

3-137. Addressing issues
The analysis process begins with examining the testable OIC in chapter 1 of the TEP and is followed by determining how the issues will be addressed in terms of test variables, method of evaluation, test length, and sample size. This process includes identification of the test purpose, scope, and tactical context for the test. This process provides a general level of test requirements.

3-138. The test purpose
The test purpose statement provides the test officer with the reason for the test. It must answer two questions: Why is the test required and what will be done with the test results? Answering these questions requires an understanding of the proponent's view of the test. The initial research should provide the answers. Some example purpose statements are shown in figure 3-34. Notice that in every case, exclusion of the last

sentence (disposition of results) would make the purpose statement incomplete.

(INSERT FIGURE 3-34)

3-139. Scope and tactical context
The scope and tactical context provide the general conditions under which the test will be performed.

a. The scope is a narrative of the location, duration, and overall timeframe of the test and a summary of the testing to be accomplished. The particular information included varies from test to test. Subjects may include quantity and type of forces involved, requirements for control, requirements for instrumentation, desired levels of realism, need for live fire, division of the test into phases, nature of data (objective, subjective, MOPs, etc.) to be collected, and any specific test events required. Information such as general test concepts and design based on employment of the tested system or concept, limitations or advantages inherent in the test concept, and the comparison of items with descriptions of the characteristics to which the test item is to be compared may be cited.

b. The tactical context is a description of the military environment in which the item or concept will be tested. As in the scope, the information included varies from test to test. Subjects may include the assumed level of conflict intensity (e,g., mid-intensity), description of the threat, missions to be performed by the test unit, summary of the scenario (including reference to the applicable TRADOC standard scenario), nature of terrain and environment, and departures from doctrine. Realistic battlefield environmental conditions will be described.

3-140. OIC and OTMOP
OIC is a generic term which is used to include issues to be addressed in user testing. FDTE, CEP, and CTs will normally use the OIC for the issues and criteria to be addressed in test. Materiel and IMA program tests will normally use the terms OIC, COIC, and AOIC. Operational issues are questions with associated criteria which are addressed by the evaluator. The OIC include the COIC developed by the CBTDEV and the AOIC developed by the evaluator to complement and supplement the COIC. OIC cover the aspects of a system which are applicable to the OTE of that system. See Section IV for a detailed discussion of OIC. The approved TEP will normally identify exactly which issues (OIC or COIC/AOIC) should be addressed by OT, by DT, and by other means, such as modeling and simulation or market surveys. The TEP provides the conditions, range of conditions, event matrixes, and data requirements for a user test of the evaluation issues. The

tester may determine that there are limitations which preclude, completely or in part, the address of a particular issue in this user test. The evaluator is informed, and the limitation is fully explained in the TEP.

Section XIX
Identification of Test Variables, Factors and, Conditions

3-141. Variables
A variable is some measurable or describable aspect or factor of a system and/or the system environment which is subject to change. It is a feature of the test item or concept or a feature of the environment which can be observed and described. Variables are the building blocks from which the test is designed. For this reason, identification and classification of test variables are critical. There are three types of test variables: independent, dependent, and extraneous.

3-142. Independent variable
An independent variable is a factor whose behavior is not dependent on other variables. An independent variable is normally set and held at one or more levels during the test. It is intentionally and systematically varied or allowed to vary so the effects of such changes on the dependent variables can be observed. For example, in an operational test of a machine gun, the independent variables could include range of engagement, target type, type of sight, and light conditions.

a. The number of levels of each variable is the number of values the tester plans to allow the independent variable to have during the test. In the example given, the tester might establish the range of engagement at three levels--200, 600, and 1,000 meters. Similarly, he might establish the light conditions at two levels--daylight and darkness.

b. An independent variable is systematically varied when a specific plan for values the variables will assume is made a part of the variable treatment plan.

c. An independent variable is tactically varied when the variable is allowed to assume any value which results from tactical conditions in a field situation.

3-143. Dependent variable
A dependent variable is a factor whose behavior is a function of one or more identifiable independent variables. The tester observes the dependent variable to see the effects of varying the

independent variables. Changes in the dependent variables should result from changes in the independent variables. In the example given above, the dependent variables could include percentage of hits and average miss distance. Dependent variables are sometimes referred to as MOP and are often specified in the TEP as part of the criteria.

3-144. Extraneous variable
An extraneous variable is a variable that is not selected or cannot be selected for treatment as an independent variable but is expected to produce some effect on the dependent variables. One of the primary considerations in designing a test is the desire to minimize and/or document the effects caused by extraneous variables.

a. Some extraneous variables are called random error variables because they vary in a seemingly random manner and can cause the value of the dependent variables to either increase or decrease. Weather is an example of an extraneous variable which produces random error. Increasing the length or number of iterations of a test tends to average out or dilute the effects caused by random errors.

b. Other extraneous variables are sometimes called constant error variables because they affect the dependent variables in a constant direction and cause a bias in the results. Differences in leadership or training between units used to test different procedures for accomplishing the same tasks may introduce such a bias or constant error. Test design techniques such as rotating units and/or operators through both procedures being compared may reduce the adverse impact of constant error extraneous variables.

c. Thorough documentation of the conditions existing during a test is necessary to enable the analyst or the user of the test results to gauge the effects of extraneous variables.

3-145. Variable identification
There is practically no limit to the number of variables associated with a test. The test designer's goal is to find the major variables which may impact significantly on the test data. This process is more of an art than a science, but the following guidelines may help:

a. Visualization consists of visualizing the item or system performing its mission in an operational environment. During this step, the test officer should record every variable he identifies. This is often a good time to enlist the aid of personnel of varied backgrounds. Often important variables which

are not indicated from other sources will be identified based on experience.

b. Analysis of test issues is one of the richest sources of significant variables and the primary constraint in limiting the number of variables to be examined. The identified courses of action imply at least a part of the list of treatments. For instance, in an OT the decision problem might involve a choice between two developmental machine guns. This would make the type of weapon an independent variable.

3-146. Variable classification

Once identified, the variables should be recorded and classified similar to that shown in figure 3-35. This classification is tentative and may change as planning continues. It must be noted that such variables as MOS of gunners and level of training could either be held constant or could be systematically varied. In the latter case they would be classified as independent variables.

(INSERT FIGURE 3-35)

3-147. Treatment of test variables

a. After the variables are identified and classified, it is necessary to decide how the independent and extraneous variables will be handled. These decisions will form the basis of the test design.

b. The tester must specify exactly how each independent variable will be allowed to vary during the test. For example, if data is to be collected both during daylight and darkness, the independent variable "light condition" is said to be tested at the levels of "daylight and darkness."

c. The independent variables should be varied by a limited number of discrete increments to ensure that data can be collected under comparable conditions. It may be impossible to make any valid statements concerning the percentage of hits of machine gun A at 800 meters versus the percentage of hits of machine gun B at 900 meters.

d. For example, the independent variables in figure 3-35 could be varied as shown in figure 3-36. In figure 3-36 there are 48 distinct combinations of the five independent variables and each combination will generate different data for the dependent variables.

(INSERT FIGURE 3-36)

e. The addition of another independent variable (two types of ammunition) would increase the number of combinations to 96 (if the dependent variables are to be measured under all possible combinations). For this reason, caution must be exercised at this point to keep the number of combinations and therefore the size of the test to a manageable level.

f. The tester must attempt to control the effect of extraneous variables. In some cases this can be done by holding the extraneous variables constant. For example, in figure 3-19, the gunner MOS and the level of training can be held constant by selection of test participants. Weather can be controlled to some extent by the selection of test location and season.

3-148. Basic test designs

The overall test design must provide the tester a framework that will allow for the logical and controlled collection of data. Whenever possible, the test should be structured to allow for evaluation by comparison of data. There are three basic test designs that can be used in most user testing: new system versus replaced system, with versus without, and new system versus predetermined standard.

a. When the function addressed is currently being performed by a standard inventory item, the comparison may be between measured performance of the tested system and the performance of the standard system under the same circumstances.

b. The comparison is between the measured performance of an organization in accomplishing the given function with the tested system versus without the tested system.

c. The comparison is between measured performance of the tested system against a set of predetermined standards.

Section XX
Test Length and Sample Size

3-149. Sample size requirements

In user testing the determination of the time and sample size required to collect the appropriate quantity of data is usually a difficult process requiring advance planning. For example, how many operators, machine guns, and rounds are required to provide a valid estimate of hit performance? These decisions must be made based on the population, anticipated dispersion of the data, and required level of confidence. Then, based on combinations of test conditions, the required test time can be estimated. In

many instances, the test will be constrained by resource and time limitations. Analysis personnel must resolve differences between required and available resources and time. Paragraph 3-96, above provides a detailed discussion of sample sizes. There is some guidance on determining sample size requirements for RAM in Mil-Std 781D and DOD 3235.1-H, and in Part One.

3-150. Bases of sample size
In general, the test duration and sample size is based on the minimum amount of testing required to reach definitive conclusions concerning the test item performance as needed for evaluation of the issues and criteria. The determination of sample size and duration of a test is based on statistical procedures, military judgment, or a combination of both, depending on the item under test. Likewise, the analysis of test results may be statistical or subjective.

3-151. Statistical sample size procedures
For those occasions where statistical procedures are appropriate, various probabilistic tables and curves are used to determine the minimum test required to ensure, at a desired confidence level, that a bad item will not be accepted by the appropriate decision makers even though it seems to meet performance criteria and that a good item is not rejected by the appropriate decision makers even though it does not seem to meet the criteria. While the procedures outlined in AR 702-3 apply specifically to RAM testing, similar procedures will be used in the selection of sample sizes to test other criteria, such as accuracy of location and probability of detection. Statistical procedures, for example, are almost always used when dealing with reliability criteria. Reliability requirements should be stated in terms of the lower test limit and the upper test limit.

3-152. Derivation of test limits
For those occasions where the lower test limit and upper test limit are not provided in the requirements document or the development plan, the test directorate should request that the CBTDEV, after reaching an agreement with the MATDEV, provide the required values. If the directorate cannot get the required values in time, the test officer and analyst should select the values based upon subjective analysis. These values will be based on the following considerations on a case-by-case basis:

a. The essential and desired criteria in the requirements document.

b. Military experience and judgment.

c. Previous test results of the item or similar items.

d. Resources required to test given values and the desired discrimination between "good" items and "bad" items.

e. Performance levels of items which it will replace and the importance of any additional capabilities of the test item.

3-153. Test sample adequacy
Statements concerning the adequacy of the sample size or test duration should be included in the scope of the TEP.

a. This paragraph should provide a statement concerning the test criterion (if one can be identified) which controls the overall sample size or test duration. For example: "The sample size of 1,000 rounds is required to test the compatibility of the item with the M198 and M109A4 howitzers using the M3, M4, M119, and M203 propelling charges."

b. The adequacy of sample size with respect to other criteria should also be addressed. For example: "The sample size of 1,000 rounds will provide a 30-percent risk to the user that an item with a true reliability which does not meet the lower test limit will be accepted as meeting the requirement." and, "A 10-percent risk to the developer that an item with a true reliability which meets the specified value will be rejected as not meeting the requirement."

c. If the sample size is inadequate to provide an acceptable risk with respect to any criterion, this should be emphasized in the scope paragraph. For example: "The sample size of six missiles is not adequate with respect to the required in-flight capability of the missile. The six missiles provide a 70-percent risk to the user that an item with a true reliability which does not meet the lower test limit will be accepted as meeting the requirement and a 40-percent risk to the developer that an item with a true reliability which meets the specified value will be rejected as not meeting the requirement."

3-154. Use of military judgment
If statistical procedures are not appropriate for the determination of sample size or for analysis of test results, then military judgment and subjective analysis must be used.

Section XXI
Level of Realism Required

3-155. Realism requirements

Simulation of operational realism is an essential part of almost all user tests. Test concepts and plans that do not propose to check for possible degradation of system performance due to realistic conditions of employment fail to address a critical decision area and can seriously reduce the value of the test results. For this reason, both DOD and DA have placed continued emphasis on evaluating new equipment and tactical concepts under the most realistic battlefield conditions possible.

3-156. Levels of operational realism
The requirements for design of a test to meet a realistic test environment must include an appropriate level of operational realism. The conditions for test environments will normally fall into one of three categories of operational realism: maximum, limited, and minimal.

a. Methods available for this type of test include initial and update briefings for players, aggressor action, simulation of higher and adjacent units through message traffic and others, and direct intervention by controllers. Direct intervention is always a final resort.

b. Requirements for this type of test are similar to full tactical simulation. However, the control procedures are usually less elaborate.

c. Although little realism is simulated in tests of this type, there is a necessity for frequent checks and close supervision to be sure that an item or concept is properly employed by the user. For these tests, this section describes the frequency of checkup inspections and the indicators to be checked. For example, for user evaluation of flight suits, the test officer must check to ensure that the suits are being worn on a regular basis.

3-157. Realistic Battlefield Environmental Conditions (RBECs)
RBECs are those natural and artificial (tactical) (friendly or enemy induced) elements employed for the conduct of OT to achieve as realistic and representative a battlefield as possible.

a. The consideration of RBEC must occur early in the test planning process. It is the responsibility of everyone in the testing process to ensure that the issue of operational performance in a realistic environment is thoroughly addressed. This requires that issues requiring evaluation under RBEC be identified at the beginning of the test planning phase and carried through the OTP, TEP, DTP, and the TER/OA. This is necessary to ensure the validity of the test results.

b. If factors such as natural obscuration, weather, and terrain are important to the test, they can be addressed to some extent by specifying the test location and date. Other factors are influenced by the intensity of the conflict (conventional, chemical, nuclear, etc.) and the operational capabilities (current or proposed) of the forces involved.

c. Decisions that will limit the realism of the test (essential RBECs) must be fully documented in the test limitations portions of the test plans and reports. Areas which should be addressed in the formulation of the definition of conditions include employment of opposing forces (OPFOR), scenario, terrain, obscurants, weather and illumination, electronic warfare, and NBC.

3-158. Opposing forces (OPFOR) play
Simulation of a realistic OPFOR is an essential element of most tests. Validity of test data and analysis depends on the degree to which test conditions coincide with likely combat conditions. Part One discusses threat for T&E in detail. Guidance for OPFOR development is available from four major sources.

a. The System Threat Assessment Report (STAR) is an integrated assessment of projected enemy capabilities which could neutralize or degrade a specific friendly system or concept. It serves as the basic threat document.

b. Threat test support package test setting and threat elements are the most useful for defining the expected battlefield realism.

c. FM 30-102 and FM 30-103 are accurate basic documents for OPFOR establishment. These aggressor manuals describe a hypothetical but realistic OPFOR including tactics, equipment, and organization. This source is unclassified.

d. TRADOC standard scenarios consist of various scenarios which depict U.S. forces in conflict with real world OPFOR. The scenarios are expressions of TRADOC and FORSCOM emphasis on OPFOR realism. Each scenario was developed by CACDA and the service schools to provide standardized realism in training, testing, and evaluation. This source is classified.

3-159. OPFOR in TRADOC standard scenarios
The first responsibility is to be familiar with the standard scenarios to ensure that they suit the test situation. The scope of the OPFOR was considered when the OTP or RS was formulated. Testing should generally examine worst-case situations. Unless the test issues are specifically limited to a particular set of

parameters, the worst-case OPFOR will give the most acceptable results. A realistic battlefield environment simulating the worst case would include as many conditions of continuous combat as possible. Development of the analysis of issues defines the environments to be simulated. Tests will require smaller sized units than are portrayed in detail in the standard scenarios.

3-160. Refining TRADOC standard scenarios
When refining the appropriate standard scenario sequence and OPFOR documentation provided by the test proponent, the test officer should consider the following areas:

a. Adequacy of scenario version to test requirements.

b. OPFOR troop list, training, weapons and equipment simulations, and tactics and strategy.

c. Approval and/or certification of OPFOR requirements by appropriate agencies.

Section XXII
Test Structure

3-161. Development of the test structure
The test structure is the basic overview or description of how the test will be performed. It results in the general parameters, phases, and schedule for the test execution and generates requirements for test control activities, data management, and other detailed aspects of the test design planning. The test structure is usually derived from a four-step process which consists of refining and analyzing the variables, factors, and conditions identified during the preliminary planning phase; combining the conditions to determine the required set of test conditions; structuring subtests, phases, or events based on the required set of conditions; and determining the number of trials necessary for execution. The DR developed in the POA are essential for this process for identification of the final set of required conditions.

3-162. Revision of the factors and conditions
The test officer must review the preliminary list of test variables and adjust for these factors and conditions that must be added or deleted to meet final test requirements. The adjustment must be made based upon the data required to answer the test issues.

a. As previously stated, independent variables or factors may be controlled in one of three ways: tactically varied, systematically varied, or held constant. Tactically varied factors are preferred because they develop as a result of tactical operations employed in the test and enhance test realism. When test time is limited, systematically varied factors are used to permit examination of all required factors in sufficient quantity for effective analysis. Factors are held constant for the test when prior knowledge or testing indicates a preference.

b. Uncontrolled factors should be held to a minimum. When critical factors for a system are identified, the most representative are developed for such factors with the number of conditions held to a minimum. For example, the terrain factor for testing a tank system may have swampy, flat, rolling, and mountainous conditions. Since flat and rolling are most representative of expected operational areas of employment, swampy and mountainous conditions would be excluded unless essential to understanding the system's effectiveness.

c. Ordinarily, average conditions are most representative, but extreme test conditions could be more appropriate for user testing. For example, the training level used in user testing to address specific issues could be untrained or highly proficient instead of average. An example of typical factors and conditions is shown in figure 3-37.

(INSERT FIGURE 3-37)

3-163. Combining conditions
The selected set of test conditions is used to determine what combinations of conditions are appropriate.

a. For example, a hypothetical system's target detection capability could be influenced by three training level conditions (untrained, average, and highly proficient), three weather conditions (clear, overcast, and precipitation), and two terrain conditions (flat and mountainous) and would require consideration of 18 possible test combinations (3 x 3 x 2 = 18). The radio communications capability of the hypothetical system could require consideration of training and terrain conditions (3 x 2 = 6 combinations) because weather conditions have little effect.

b. A suggested technique is to draw a matrix listing possible combinations that interact and influence system performance. Normally, systematically varied controlled factors form the basis of this matrix.

3-164. Structuring subtests, phases, and events
Combinations of conditions are considered for selection in the least number of groupings which will allow a practical and realistic exercise.

a. Care must be taken to avoid groupings of incompatible conditions (e.g., live fire versus live targets) and unrealistic conditions (e.g., concentrated armor attack under nuclear attack).

b. Each grouping becomes one test subtest, phase or event. The tester identifies the types of trials which are to be conducted and the conditions under which they must occur. He then organizes them into appropriate groupings identified as phases or subtests.

c. Substantially different test phases generally require separate matrixes. Test event matrixes typically require supplemental notes, annotations, or accompanying text to clarify information. In particular, such supplemental material identifies the manner in which events are grouped into trials, missions, and phases and provides guidance concerning sequencing or prioritizing the conduct of test trials and their embedded test events.

d. Done properly, implementation of this process by the tester ensures appropriate operational realism, prevents players from second guessing test events, and minimizes potential bias in the data. It allows flexibility of test conduct and provides sufficient test control to meet safety, instrumentation, and test management requirements. An example of a test phase matrix is shown in figure 3-38.

NSERT FIGURE 3-38)

3-165. Number of requ d trials
The number of trials fo an event or sequence of events is normally dictated by statistical criteria required to support the evaluation procedures and analysis stated for the issue, criteria, or MOP. The required sample size is determined numerically by defining statistical parameters and formally calculating the sample size. Where there are no statistical criteria, test designers must determine how many test trials are necessary to average out chance differences between repetitions of specific events. Essentially, this process determines how many repetitions are required to provide confidence in value derived from summing trials. A trial matrix is developed for each set of requirements to show the required number of

iterations to be conducted to achieve the necessary level of data collection. An example event matrix is shown in figure 3-39.

(INSERT FIGURE 3-39)

3-166. Use of test structure
When completed, the test structure provides the test officer with the general plan that can be used for the development of a test schedule and execution and control requirements for all other aspects of the test. The test officer uses this information as the foundation of chapter 3 of the TEP.

Section XXIII
Test Control

3-167. Test control planning
This section describes the procedures, documents, and functions that must be developed to ensure that the test can be properly organized, controlled, and executed to generate the required test data. The basic products of this action are the development of the TEP Control Concept and the DTP Control Plan. The actions and/or documents described in this section must be performed as developed in order to provide detailed instructions and procedures for control and execution of the test.

3-168. Program of events
This section provides both an outline of what should occur during the test and a detailed time schedule of explicit events. The organization and level of detail of the program of events depend upon the level of simulated realism required.

3-169. Overall test scenario
This outline divides the test into days, mission profiles, events, subtests, phases, or any other convenient divisions. A day or a mission may be repeated a number of times to develop sufficient data as required by the event matrixes. Any such repetition should be scheduled to agree with ordering constraints or randomization requirements in the matrix. This outline reserves periods within which events occur and serves as a tool for coordination. General procedures are developed to address delays or other events which preclude accumulation of scheduled data due to weather, instrumentation failures, system failures, or other such events.

3-170. Detailed test scenario
The detailed test scenario consists of a time schedule of events, a description of events, and associated documents for event

inputs. Based on the overall test scenario, realistic operational events are scheduled into appropriate time blocks using enemy threat documentation, U.S. doctrine and tactics, and test constraints.

a. For test scenario purposes, an event is something that can be controlled and scheduled to occur at a specified time. For example, the initial conditions (time, location, tactics, force sizes) for an opposing force ambush of a friendly infantry platoon can be specified in advance, so such an ambush can, therefore, be considered an event. However, the resultant actions following the ambush are generally unpredictable, so they would be regarded as test outcomes rather than test events.

b. Appropriate documents used to support or initiate test scenario events may be operations orders, intelligence reports, fragmentary plans, and simulated enemy documents. The completed detailed scenario is the principal control mechanism for the test.

c. A major function of the pilot test is to examine the adequacy of this mechanism and identify changes necessary for the actual test. Procedures are developed to monitor scenario execution during the actual test to verify that programmed events are executed in accordance with the detailed scenario.

3-171. Full tactical simulation
For tests which require simulation of a tactical environment for extended periods, the program of events will consist of a complete scenario.

a. Essentially, a scenario is a narrative which merges the test events into a realistic and believable sequence. A scenario describes the actions of all player and OPFOR units and includes all information which will be presented to the players. This information includes initial and update situation briefings, operations orders, fragmentary orders, intelligence summaries, messages, and other information designed to evoke player response.

b. Particular attention must be paid to the actions of OPFOR. Their operations should in all cases be consistent with the tactics of the threat force being considered.

c. All scenarios must be based on one of the TRADOC standard scenarios. The particular standard scenario to be used is agreed upon by the test organization and the proponent, usually during the OTP preparation or the preliminary test planning phase. In preparing the scenario, it is essential to specify the time and

location of each planned event. A recommended format for the scenario is shown in figure 3-40.

(INSERT FIGURE 3-40)

3-172. Limited tactical simulation
In tests which do not require maximum combat realism, the preparation of a scenario is unnecessary. It is, however, necessary to develop a detailed description of the events that will occur. The description should be sufficiently detailed so that the events can be properly executed without additional information. For each event the method, time, location, participants, and information to be provided must be specified. It is often possible to group similar or near simultaneous events into subtests. This reduces the volume of necessary description and makes conduct of the test more efficient.

3-173. No tactical simulation
For tests such as user evaluations and some customer tests, no simulated realism is required. For such tests, the event summary can be augmented as necessary to provide a description of the conditions or situations planned or expected during the test. Examples include identification of test units, organization of the test into phases, and expected frequency of key events.

3-174. Need for control procedures
The program of events describes in detail the events which must occur. The control procedure supports the program of events by specifying the system which will cause the events to occur. The content of the control procedures depends upon the level of simulated realism required in the test.

3-175. Control procedures for full tactical simulations
For tests of full tactical simulation, the primary control objective is to induce the test players to comply with the scenario. In support of this objective, the control procedure should describe the control organization and responsibilities, the scenario revision and documentation, and the casualty assessment requirements.

3-176. Control organization and responsibilities
The control organization and responsibilities section will describe the structure of the control group down to individual level. The required background and qualifications for each member of the organization will be specified. The mission and responsibilities of each subunit will be described in detail. No single organization is applicable to all tests. Every control organization requires a centralized headquarters to issue instructions, reallocate assets, and monitor progress. In

addition, field controllers are required to provide information to the headquarters and to intervene, if necessary. These field controllers may accompany the units or they may be assigned to locations in the test area. Occasionally, a combination of unit controllers and area controllers is necessary.

3-177. Scenario revision and documentation
Since the scenario is a very detailed document, it is to be expected that changes may become necessary during the test. Major changes may require proponent concurrence. When information from field controllers indicates that a change has occurred or will occur, the control headquarters should be prepared to revise the scenario in order to ensure the occurrence of required events.

a. This section of the control procedure should contain guidelines for revising the scenario and should direct procedures for documenting the revisions. Figure 3-41 is an example of revision guidelines.

(INSERT FIGURE 3-41)

b. The best procedures for documenting a revision is to keep a log within the control headquarters. This log should list all test events, by time and location, as well as directed revisions. This log then becomes a revised scenario.

3-178. Casualty assessment
An essential element of full tactical simulation is the method used for assessing casualties during engagements.

a. When instrumentation systems are used, this section should describe the vehicle and weapon simulations. Guidance on employment of instrumentation systems must be obtained from the agency or office that maintains and operates that system.

b. If controllers assess casualties, then the procedure must be specified in detail. Guidance on assessment procedures can be found in plans of prior tests and in FM 105-5.

c. The assessment of casualties is of crucial importance, not only because it directly affects test data but also because it has a major effect on troop enthusiasm and morale.

3-179. Control procedures for limited tactical simulations
The control procedures for limited simulation tests is similar to that required in cases of full tactical simulation. It is usually, however, less elaborate since the control function is less complicated. Since this category covers a wide range of

tests, the best guidance in planning the control procedures will be obtained from plans of similar prior tests. As a minimum the document should include the control organization and functions, a method for revising the program of events, and a system for documenting the revisions. Casualty assessment may be required for some tests of this type.

3-180. Control procedures with no tactical simulation
For tests with no simulation, the control procedure consists, as a minimum, of two parts.

a. The first part describes the supervision and monitoring that the test officer or other controllers will perform to assure that the test item or concept is being employed properly. The description should include a schedule of visits or inspections and a listing of points to be checked. Such frequent checks are necessary to assure that misuse or misunderstanding does not bias results of the test.

b. The second part should outline contingency procedures to be employed if any required events do not occur in the course of the test unit's operations. These procedures will often involve some limited simulation testing. Any additional information which would enhance understanding of the conduct of the test should be included.

3-181. Pilot test
A pilot test is an abbreviated version of the actual test and is conducted in advance to detect deficiencies in the plan. For this reason it should, as a minimum, include the exercise of each type of required event and make use of each data collection, data reduction form, and mechanism to be used in the actual test. A complete end-to-end run of data management procedures will be conducted as a part of the pilot test.

a. The pilot test should be provided for in the control plan with sufficient time between pilot test and the start date of the actual test to allow for reaction and correction of any deficiencies encountered in control, data collection, and data reduction. Tests relying heavily on instrumentation may require additional time after the pilot test for the correction of problems.

b. Accomplishment of an abbreviated program of events is usually sufficient, although an abbreviated control procedure may also be required.

Section XXIV
Test Data Management

3-182. Data management planning
This paragraph describes the procedures, documents, and functions that must be developed to ensure the collection and processing of test data. Planning data management functions should begin early in the overall process and continue through the test planning cycle. Good data management plans are essential to ensure that all the resources which were expended in the planning and execution of the test result in test data which can be used to address the issues of the test. The basic products of this function are the Data Management Concept in the TEP and the Data Management Plan in the DTP. These include data collection, data reduction, quality control, and written procedures for reduction and analysis. Detailed discussions of the data management function are provided in chapter 5.

3-183. Data collection
The purpose of data collection is to assure that all required data generated by test events is recorded and transmitted to the data reduction element with a high level of accuracy. The functions of data collection include gathering, recording, checking for correctness and completeness, and safekeeping. The plan for data collection is based upon the data collection concepts developed during the test design phase. The plan is divided into two major sections--the first section deals with the data collection organization and its functioning; the second section concentrates on the detailed arrangements for recording data.

3-184. Data collection organization
The data collection organization and procedures must be developed to ensure that data collectors and instrumentation will be in the right places at the right time to obtain the required data. Plans must be developed to describe when, where, and how checks of data forms or instrumentation outputs will be made to ensure that data are being collected and recorded according to the definitions and formats required.

a. The data collection section typically consists of teams which are assigned to data collection stations. These stations may be moving (e.g., with a tank in the attack), permanent (e.g., at the same location for the whole test), or temporary (e.g., at a given location during only one part of the test).

b. Whereas controllers are concerned with the test input or stimulus, data collectors are concerned with the test conditions

and the output or response of the test item and player participants. Some data collectors may be tasked to operate automatic or semiautomatic data collection equipment.

c. As a minimum, the plans and organization must cover the following items: composition, allocation of collection means, gathering, data recovery, and coordination.

(1) A chain of responsibility is established and mission statements are provided as required.

(2) Each data recording agent (human or instrument) is assigned to a player unit or location, and the data to be collected are identified. These arrangements are closely dependent upon the control plan. Provisions are made for such items as relief of data collectors and instrumentation battery changes.

(3) Procedures and schedules are established for the periodic pickup and control of manually recorded data from collectors. Prompt consolidation of data reduces the likelihood of loss and allows concurrent monitoring for incompleteness or error.

(4) Procedures are specified for attempting recovery of data which are lost or erroneously not collected. Such procedures are to be instituted quickly while the data may still be available or can most easily be reconstructed.

(5) Plans are made for continuous monitoring of the test events. Changes in the sequence or timing of events may require reallocation of data collection means. This is best accomplished by coordination between the control headquarters and the data collection headquarters.

3-185. Data recording procedures

This portion of the plan specifies procedures for the actual act of recording the generated data. The method of recording each data element is specified and documented in the TEP. In general, data will be recorded manually by the data collectors, by instrumentation alone, a combination of the two methods, or by the players. This section consists of the data forms, questionnaires, and instrumentation codes to be used in the test. In cases where instrumentation is used, backup data forms should be considered for use in the event of instrument failure.

3-186. Data reduction

The purpose of data reduction planning is to establish the organization and procedures for performing preplanned data base

formulations and computations on the test data in accordance with the data analysis requirements. The contents and size of the data reduction plan that is developed are highly dependent on the magnitude and nature of the reduction effort. This plan normally consists of the data reduction organization, reduction procedures, data base development, and data presentation formats.

a. The plan for the data reduction organization should identify who will reduce the data and what general methods will be used. The reduction element is divided into teams, if necessary. Also included in the plan is a discussion of the functions and responsibilities of key section personnel and personnel rotation schedules.

b. Data processing begins when complete, properly formatted data are received from the data collection section. It ends when the final test data base is produced. This includes entering manual and automated data into an automated data base and performing both manual and automated reduction and quality control procedures, as well as constructing and maintaining files to provide a complete test data audit trail from collection (instrumentation tapes, video tapes, and paper files of original manual data forms, data collector logs, controller logs, interviews, etc.) through any interim reduction process to the final test data base.

c. Interim reduction consists of manual or automated procedures which transform data from the data collection means to the form required in the final data base. Manual reduction includes processes requiring expert analyses and judgment such as extracting quantitative data from video tapes and examining data from multiple sources to resolve apparent contradictions. Automation is used whenever it can sensibly replace manual reduction procedures.

d. Responsibilities of key personnel and overall organizational structure are designed to accommodate data entry, data reduction and validation, and audit trail preservation. The data reduction section typically requires personnel from several agencies or contracting organizations at many different levels possessing skills from a wide variety of disciplines. Organization of the section should allow for unusual duty schedules or frequent rotations of technical personnel to permit timely reduction of test data and to accommodate personnel constraints of other agencies.

e. Data reduction procedures provide detailed instructions to data entry and reduction on the actions required for processing of the test data. Instructions include requirements for data

input, individual steps for reduction, and other requirements. This plan may not be necessary when reduction is to be performed by the test officer or by a small group of experienced individuals familiar with the reduction requirements. It is, however, necessary in tests where the reduction organization is very large, the volume of data is very large, or reducers lack sufficient knowledge or expertise to execute the reduction plan without additional detailed instructions.

f. Data flow descriptions, both within the data management section and between elements of the test directorate documents procedures and schedules to be used for data transmittal. Particular attention is paid to feedback loops, both within the data management section and among data control, collection, and management elements. In addition, feedback loops from emerging evaluation and statistical analyses are generally established.

g. Data reduction plans describe procedures to ensure integrity of the test data base. In particular, they specify data entry and updating procedures which preclude transcription errors and unauthorized access and provides for a complete audit trail for the data.

h. Data presentation specifies the format which will be used to present summarized test results in the final report. For full evaluation systems this is usually based on the presentation techniques proposed by the evaluator in chapter 2 of the TEP. Such preplanning is usually necessary for tests involving a large volume or extensive variety of data. For such tests, it is necessary to plan presentation formats so that they can be produced during the reduction effort. For abbreviated evaluation systems, the tester develops the forms data presentation. Reports of similar past tests may include usable methods of presentation.

3-187. Quality control
The quality control procedures should describe in detail the data management procedures which ensure that the correct data are collected and that the data collected are correctly processed.

a. Both manual and automated checks are used to ensure that data are correctly entered and checked accurately. Although manual checks often include extensive review of computer printouts, they should not generally involve extensive arithmetic operations. Such operations, together with repetitive logical checks, should be automated to the maximum extent. Manual checks consist primarily of checks which cannot be easily automated (such as review of graphical displays) and assessment of related data from several sources for overall consistency.

b. Data management quality control procedures provide mechanisms for adding or changing data requirements and for modifying data collection or reduction procedures based on examination of emerging test data. This differs from the quality control procedures in data collection which are generally limited to assuring that data are completely and accurately collected.

c. The data reduction responsibility is to ensure that data taken as a whole represent what actually happened during test. It stops short of evaluative analyses of test data, which are primarily concerned with the interpretation and significance of test data within the broader framework of a system evaluation.

3-188. Data authentication group (DAG)

DAG organization and procedures are documented in the TEP. The need for a DAG was established in TEP chapter 2. A discussion of the DAG is provided in chapter 5. The principal product of a DAG is high-fidelity, validated data bases from which the events of the test can be revisited. Resources to support the DAG will be identified through the TSARC process on the OTP.

3-189. RAM scoring conference procedures

The test officer should develop detailed RAM scoring conference procedures, in conjunction with the chairman of the scoring conference, for inclusion in the overall data management plan. Formal RAM scoring conferences are held during and immediately after an operational test. The objectives of the scoring conferences are to establish a common test data base and to ensure that a proper and consistent categorization (assigning classification and chargeability) of test incidents is made using the approved FD/SC. Detailed procedures for the RAM scoring conference are provided in Part One and AR 702-3.

Section XXV
Test Training

3-190. Training of personnel

The training plan is an essential element of the overall test planning process. Requirements for training are developed during the evolution of the control, data collection, and data reduction plans. For each category of personnel, requirements for training are identified. A program for eliminating these shortfalls is then developed. Training plans include designation of attendees and instructors, lesson plans, examinations, performance tests, schedules, and location of instruction. Standard Army formats for these documents should be used.

3-191. Player personnel
Training of players should provide individual, section, and unit level skills necessary to operate and maintain the equipment or perform the tactics to be tested. The results of the test will be sensitive to the amount and quality of player training. In fact, for some tests the amount and type of training received by various groups of players will be a major test variable. For all tests, the actual training received should be documented and will become a part of the final report. The tester must receive the trainer's Operational Test Readiness Statement (OTRS) before proceeding with testing.

3-192. OPFOR personnel
In those tests where OPFOR is included, the units portraying the enemy should be trained to employ the tactics of the threat force. The employment of U.S. tactics and procedures by OPFOR may invalidate or cast doubts on results of such a test. Specified tests may require that certification of threat forces be provided and a high level of training required.

3-193. Test controllers
Controller training requirements describe the training to be given to the control section personnel, as well as the procedures to be used to determine whether training was effective. At a minimum, controllers are to be completely familiar with the control plan, the data management and collection plans, and system safety constraints. Training includes test issues, scope, system orientation, safety releases, subtests and field exercises, duty schedule, and communications procedures or radio nets. Particular attention is to be given to training controllers not to cue test players to pending events. Controllers require the capability to make sound, independent decisions on control matters and to implement emergency procedures in the absence of communications. Controllers also require the ability to act as data collectors if the need arises.

3-194. Data collectors
Data collector requirements describe training to be given to data collectors and instrumentation operators as well as procedures to determine whether training was effective. Data collectors require familiarity with the control plan and the data collection and reduction plans, as well as the test issues, test scope, subtests and field exercises, test item characteristics, instrumentation, duty schedules, and communications procedures and radio nets. Detailed training in the correct use of data collection forms is always required. Particular emphasis is given to the need for accuracy and unbiased objectivity. Selected data collectors and supervisors may require detailed training on operations or maintenance of the tested system. In

addition, training is to stress that data collectors are not to cue test players to pending events. Data collectors should also be trained to implement emergency procedures if necessary.

3-195. Data reduction/entry personnel
Training for data reduction/entry personnel should provide familiarity with the data entry requirements and data reduction plan. Formal instruction is usually necessary and training time and other resources must be planned accordingly. Practical exercises with dummy data will provide the best preparation.

Section XXVI
Instrumentation

3-196. Instrumented data collection
The collection of test data through the use of automated instrumentation systems is a key factor in the majority of tests conducted. In addition, instrumentation systems, to include models and simulations, are often employed to provide realistic simulation of combat environments (weapons simulator, NBC simulants, etc.) and to generate data for systems to use in lieu of having actual forces in the field (combat simulations or stimulation models). See Part Eight for a detailed discussion of instrumentation.

3-197. Instrumentation planning
Instrumentation planning is conducted to identify those instrumentation systems that are required to collect data to address the test issues and/or to provide the necessary degree of combat environment realism or generation of cue/task loading information. The test officers must identify, through the overall data requirements identification test control procedures and data collection reduction planning, the detailed requirements for instrumentation support. See chapter [illegible] or details of the Instrumentation Support Plan (ISP).

3-198. Instrumentation sources
Many sources exist to assist the test officer in identification of available systems and the system capabilities. Test officers should coordinate with the instrumenters as early in the test planning phase as possible for identification of requirements. Instrumentation engineers will assist the test officer in the development of all instrumentation requirements for the test.

Section XXVII
Documentation of the TEP Test Design Plan (TEP Chapter 3)

3-199. Test design planning summary
There is no one single way or method that will accommodate the requirements for planning for all of the types and requirements of tests. The procedures and requirements which have been discussed serve to provide the test officer with the majority of the areas which should be considered in test planning for any type of test. Not all items will be applicable to all tests; however, consideration of all items will greatly assist the test officer in overall planning.

3-200. Documentation of test design planning.
Results of test design planning are embodied in two documents, the TEP and the DTP. These documents are the methodology by which the planning requirements are documented and approved for implementation.

a. In the TEP, basic test design is discussed in TEP chapter 3. This design planning is expanded in appendixes to the TEP which provide the concept plans for test scenarios, test threat, test control, test data management, ITTS support, audiovisual support, ADP support, test training, and other test support. Each of these topics are discussed in TEP chapter 3.

b. If the category does not apply (e.g., test will not use ITTS), this fact is noted in chapter 3 and no appendix is written. If the requirement is very simple (e.g., threat for tool kit), the entire threat may be listed in chapter 3 and no appendix is written.

c. The concept plans in the appendixes of the TEP are expanded into detailed plans in the DTP. Each of the appendixes in the TEP has a counterpart in the DTP. If the plan is simple, it may be fully developed in the TEP. If the plan is voluminous, it should be summarized as a concept plan in the TEP and fully developed in the DTP.

3-201. Preparation of chapter 3 of the TEP
This chapter is prepared by the tester except when the TEP is used to plan evaluation for a milestone that will not be preceded by a dedicated phase of user testing. In those cases, the evaluator will provide a brief statement to that effect and the remainder of the chapter is not required. As noted above, the POA is the basis for derivation of this chapter. Using the techniques described in Sections XVI through XXVI, above, the test designer develops and documents the test design as shown in figure 3-42.

(INSERT FIGURE 3-42)

3-202. Test description
Describe the test to be conducted to address the operational issues, OTMOP, and data requirements. State the purpose of the test and where the results will be used. This will be the same as the test purpose contained in the OTP. Reference authority to conduct the test to include the DA memorandum approving the current FYTP and the number of the approved OTP.

3-203. Test overview
Provide an overview of the test design. The purpose of the test design is to execute the concepts described in chapter 2 of the TEP.

a. Specify the test phases (e.g., pilot test, record trials, live firings, FTXs, CPXs, demonstrations) making up the test and summarize the test factors and conditions and events making up each phase. Describe the use of any baseline in the testing. Briefly describe execution procedures, control procedures, and any other information necessary for an understanding of the matrix(ces) that are applicable to all issues. Include information such as limitations or advantages inherent in the test concept and the comparison items with descriptions of the appropriate characteristics to which the test item is to be compared. Include provisions to ensure that test events adhere to the OMS/MP.

b. Describe the tactical context and the associated scenario (for example Middle East or European), environment, threat, tactics, and doctrine to be used in each test phase. As an example, the maneuvers of the friendly forces, threat situation, terrain, weather, and types of events to be represented in the test can be included.

c. Review and refine the factors and conditions in chapter 2 of the TEP. As necessary, the tester, in conjunction with the IOE, refines the factors and conditions by adding factors. For a given factor, the tester refines the factors by changing the number of conditions, redefining the conditions or changing the type of control (systematically varied, tactically varied, uncontrolled, or held constant).

3-204. Conduct of test
Describe the conduct of the test in terms of its tactical context, events, control, phasing, scheduling, and methodology.

3-205. Tactical context
Based on the test concept in TEP chapter 2, describe the tactical context and associated scenarios, environment, threat, tactics, and doctrine to be used in each test phase.

a. The scenario description consists of the geographic portrayal of the area, forces, and events of a hypothetical armed conflict. The CBTDEV provides standard scenarios as part of the D&OTSP (Part One). The scenarios provide a common framework of selected situations and real world conditions in which specified test events are set for the Middle East, Europe, Alaska, Korea, Persian Gulf, etc. Expand as necessary in the appendixes to the TEP and the DTP.

b. Describe the use of test site terrain for each phase, scenario, mission, or trial. Discuss the balance between realistic representation of the operational environment and the necessity to cause the required conditions to occur during programmed test events. Describe how EW; obscurants; nuclear, biological, and chemical (NBC); level of conflict intensity; mission profiles; and environmental factors are to be played.

c. Describe how the threat systems and tactics will be played in each phase. For ACAT I, ACAT II and DOT&E oversight systems, the TTSP and the STAR describe the OPFOR tactics and define the threat weapons to be employed and the size and type of the expected force. Describe the threat in sufficient detail to permit realistic testing. Testing must include an accurate representation of the threat projected to exist post-IOC. Expand as necessary in the appendixes to the TEP and the DTP.

d. Describe the friendly tactics and doctrine to be played in each phase. The phases are designed within the tactical and doctrinal framework of the D&O support package. Define how the framework will be realized on the ground within the environment of the test. Define the degree of test player free play to be allowed within the framework.

e. Include data on test player forces that will operate the system and portray the supporting, supported, and adjacent forces in play. Identify the type of test unit or organization for the test. Discuss how the unit is organized and any significant requirements of the unit. Include additional information such as TOE designation, as required.

3-206. Test events
Include discussions of the organization and overall layout of the test to include sequence of phases. Flow diagrams, time lines, and matrixes should be used as appropriate to introduce the events described. The structure of an OT differs as a function of its complexity and can be made up of a training phase, pilot test, several scenario driven test phases, and special exercises or excursions.

a. Define the test structure and, for each element, specify what is to be included and how it is to be accomplished. Based on the test approach in TEP chapter 2, describe the phases, trials, and test events to be executed.

b. A test trial is a continuous tactical exercise beginning from systematically controlled initial conditions and evolving tactically within some controlled bounds until some specified duration or objective has been met. A test trial is the smallest test planning unit that can be scheduled to occur under specific conditions at a specific time.

c. Test trials are made up of test events, which are occurrences about which data are required (such as a helicopter unmasking from a predetermined location and attempting to acquire targets quickly in a tactically deployed array). Other times test trials consist of many events which occur under different tactically varied conditions within the trial (for example, a free-play force-on-force exercise).

d. Scenarios, missions, or vignettes are built up from scheduled trials and may stretch out for relatively long periods (for example, testing of an infantry weapon through multiple 72-hour field exercises).

e. Test phases refer to distinct periods of time within which similar scenarios are conducted, possibly on ranges separated by substantial distances (such as force-on-force phase versus live-fire phase). Phases usually represent the largest breakdown of the test.

3-207. Control procedures
Include necessary descriptions of the control structure and procedures that will be used to ensure that required test events occur in situations that realistically depict the tactical context of the test in accordance with the OMS/MP. The test design ties together the control requirements for each OTMOP. The control procedures are expanded into a Control Concept in the TEP appendixes and into a Control Plan in the DTP. Develop an overall schedule of events as the basis for the detailed test schedule.

3-208. Overall methodology
Describe execution procedures, control procedures, data collection procedures, and any other information necessary for an understanding of the matrix that is applicable to all issues. Include information on limitations or advantages inherent in the test concept and the comparison items with descriptions of the appropriate characteristics to which the test item is to be

compared. Include provisions to ensure that test events adhere to the OMS/MP.

3-209. Test limitations
Describe all known limitations to the adequacy of the test (e.g., duration, number of systems, availability of interoperable systems, test unit availability, and ITTS) and their impact on the OTMOP.

3-210. Test details
Provides details of issues, events, data requirements, and data management. Describe methodologies to provide the OTMOP. The organization is directly aligned with the issues contained in TEP chapter 2. Each issue which contains one or more OTMOP is an issue to be addressed in OT. For abbreviated evaluations and for testing of CBTDEV/TNGDEV products, all of the MOP developed in chapter 2 will be OTMOP. For each OTMOP, develop and describe methodologies, test events, control concepts, data requirements, data collection and reduction procedures, and data analysis techniques peculiar to the OTMOP. If the methodologies are closely aligned for all OTMOPs associated with a test issue, they need only be stated once. If not closely aligned, separate paragraphs must be developed for each OTMOP.

a. OTMOP specific methodology. Describe the test events that need be executed to generate required data, the operational conditions under which the events must occur, the techniques for collecting the data, and the control procedures that will be used to ensure that test events occur at the proper time and place and under the conditions specified. Where appropriate, reference can be made to information previously presented under conduct of test.

(1) Required OTMOP specific test events should be listed or referenced to the appropriate general TEP paragraph.

(2) Describe the OTMOP specific control procedures and rules of engagement that will be employed to ensure that required test events occur in situations that realistically depict the tactical context of the test. Specify the level of operational realism required in the test (full tactical simulation, limited tactical simulation, or no tactical simulation) and the rationale for the choice.

b. OTMOP specific data requirements. Data requirements applicable to each OTMOP should be extracted from the POA and summarized. Present information concerning data accuracies and sample sizes unless otherwise provided in the general TEP paragraphs.

c. OTMOP specific data collection. Describe the procedures for the collection and tabulation of test data and the specific organization and procedures to be used to collect the required data.

d. OTMOP specific data reduction. Describe the procedures for the processing of test data. Each method to be employed to process data required to answer the OTMOP should be addressed. Methods include manual, instrumentation, and ADP. Requirements such as equipment, personnel qualifications, and classification of data should also be addressed.

e. OTMOP specific data analysis. Describe the logic for formulating and computing findings and any assessments which might be required. The POA is the plan as to how the data to be collected during test will be processed, analyzed, or combined to answer the OTMOP. This is an extremely important step in the test design process and impacts greatly on test execution, data reduction, and test and evaluation report writing.

3-211. Test data management
The test designer details the concepts for data management and the requirements for the tester data base. The data management procedures are expanded into a Data Management Concept in the TEP appendixes and into a Data Management Plan in the DTP.

3-212. Data collection concept
Describes the test element organization and responsibilities for data collection and instrumentation operation and maintenance. Delineate the requirements for data collector training on the test item and use of data collection equipment. Identify the classification level of the test data (when the test generates either classified data (IAW AR 380-5) or "Competition Sensitive" data, provisions for the marking, handling, storage, and disposition are to be addressed). Identify procedures by which authorized remote users can access the data along with procedures for documenting and archiving the data.

3-213. Data reduction concept
Describe the process in which recorded test data is organized, reduced, verified, managed, controlled, and stored. Organize the data in terms of the collection source (RAM collection form, cockpit digital recorder, radar tapes, etc.). Diagram the process through which each set of collected data is to pass before reaching the storage medium which supports the test directorate and the evaluator. This data flow diagram identifies where data is combined with other data, where it is processed, scored, reorganized, validated, or otherwise manipulated. This includes identifying where data is transferred from data forms to

automated form. Once the process is outlined, describe the actions which are to be performed on the data at each step. When judgement of the test directorate or DAG is required at any step, the rules or procedures to be used are delineated. After defining this process, ADP hardware, software, facilities and personnel requirements are refined, and the OTP is updated.

3-214. Quality control concept
Outline process for independently validating test data. Define checks and procedures to be used to preclude or detect and correct errors made in data collection, data entry, or data reduction. Identify emerging data summaries required to identify potential inconsistencies. Outline the process for making required corrections or changes in test data and how an audit trail for those corrections or changes is maintained. Data verification determines whether the data correctly represent the variables they characterize, and whether the data collected are adequate to support the test and evaluation reports. Specify requirements for and techniques proposed for data verification. Data collection procedures are to be validated prior to starting the test and checked during the test to insure that critical data are being accurately collected.

3-215. Data base design
When test data are extensive enough to require storage in an automated data base, describe the structure and content of the data base. Describe the architecture and design of the data base including the relationships among files and records. Design the architecture to support the view of the data required by the TEP but also support views required for test control and data quality control. The data base structure and data dictionary become the core of the data base description in the test and evaluation report.

a. Data element dictionary. The data in each file or record are to be listed and augmented by any necessary definitions. Good data definitions specify exactly what is measured when. Examples are:

(1) "Elapsed time to transmit a call is to be measured and recorded to the nearest second by a data collector at the transmitter using a stopwatch. Transmission time begins when the operator ... <specify operator action> and ends when .... <specify operation>."

(2) "RMS display range is the RMS range between the aircraft and the ground target at the time when the 1553 data bus in the aircraft confirms that the ground target symbol is

displayed on the aircraft gunner's scope. This is available from the RMS instrumentation system."

b. Provide data base structure diagrams which expand on data base descriptions in TEP chapter 2.

c. Provide a crosswalk of data elements and the data collection forms on which these data elements will be collected.

3-216. Test personnel, equipment, and materials

a. Describe the makeup and general organization of the test directorate required to execute the test as described in the test.

b. Describe test training requirements. Training requirements (actual training and necessary resources) consist of two major elements: training the test players and training the test organization personnel. The training procedures are expanded into a training concept in the TEP appendixes and into a Training Plan in the DTP.

(1) A summary of training to be given to personnel or units in preparation for certification (OTRS) and testing should be presented. Some means of training are an ARTEP, a graded FTX, special schools, and new equipment training teams (NETT). The specific requirements should be derived from the Training Support Package. (See Part One.) Contents should include brief descriptions of the skills needed and the expected proficiency levels of both typical test troops and the OPFOR. Also indicate what agency (representative of the Army trainer) will furnish the training OTRSs.

(2) Training to be presented to controllers, data collectors and reducers, and other test personnel should also be summarized. Brief statements concerning special schools, data collection and reduction methods, hands-on practical exercise, and data quality control are appropriate.

c. Describe the instrumentation and services required to support the test. Instrumentation consists of electronic devices and systems designed to collect, process, and document test event data. Include discussions of video instrumentation, existing instrumentation systems to be used, design and construction of new instrumentation devices or modification of existing instrumentation devices and systems required, and requirements for SSED for computer driven systems. Describe the use of targets and simulators both existing and new. The ITTS

requirements are expanded into an ITTS Support Concept in the TEP appendixes and into an ITTS Support Plan in the DTP.

d. Describe required audiovisual support to the test. The audiovisual requirements are expanded into an Audiovisual Support Concept in the TEP appendixes and into an Audiovisual Support Plan in the DTP.

e. Describe the architecture of the ADP support to the test. The ADP requirements are expanded into an ADP Support Concept in the TEP appendixes and into an ITTS Support Plan in the ADP.

f. List other materiel, logistics, personnel, and communications support required by the test. The test support requirements are expanded into a Test Support Concept in the TEP appendixes and into a Test Support Plan in the DTP.

g. List base and range facilities (B&RF) required to support the planned test.

3-217. Environmental and energy impacts
Summarize the environmental and energy impacts from Test Environmental Assessment (TEA) and the Environmental Impact Statement (EIS).

Section XXVIII
TEP Appendixes

3-218. Purpose of appendixes
The appendixes provide needed copies of supporting documentation, provide administrative listings, and expand TEP paragraphs into detailed descriptions. The purpose of the appendixes is to provide complete information to the reader, yet avoid interrupts in the logical flow of information in the main body of the TEP due to incorporation of too much detail. For this reason, many of the TEP appendixes are optional and are only used if the information in the particular paragraph of the TEP is of sufficient volume and complexity to interrupt logical flow of information.

a. Judicious use should be made of the appendixes to avoid sidetracking the reader of the TEP. Reference to a very short appendix is wasteful. The information should be included in the body of the TEP. If too much information is included in the body of the TEP, the reader gets bogged down with detail. In this case, the information should be summarized in the body of the TEP and covered in detail in the appendix. In no case should the

appendix duplicate material already covered in the body of the TEP.

b. For full evaluate TEP, the evaluator and the tester share responsibilities for the appendixes. For abbreviate evaluate TEP and for TEP for CBT/TNGDEV products, the tester prepares all the appendixes.

3-219. Content of the appendixes

a. Supporting documentation. This required appendix is developed by the evaluator. It provides a listing of pertinent system documentation to include, as a minimum, the MNS, ORD, TEMP, OTP, the test support packages and the TEA and EIS (if applicable). Each document will be listed by title, responsible activity, status (e.g. approved, draft, under revision), and dates of approval or date of draft. See Section III for literature search requirements. Do not attach copies of these documents to the TEP unless called out in a succeeding appendix.

b. Background. This optional appendix is prepared by the evaluator and contains details of the background of the system development and the test and evaluation of the system. If the details to be placed in the background paragraph of the TEP are so voluminous that continuity of the TEP is lost, they should be summarized in the paragraph and stated in detail in appendix B. Appendix B is optional if the details can be adequately covered in the background paragraph. (See Section VII.)

c. System description. This optional appendix is prepared by the evaluator and includes a description of the system (or combat/training development product). It should describe the system and its major roles, missions, and components or characteristics. A description of similarities and differences between the system under test and the objective system being developed is appropriate here. The concept for force structure and employment is summarized. If a large amount of detail is required to adequately understand the system, a lengthy system description is included as appendix C. Appendix C is optional if the details can be adequately covered in the system description paragraph of the TEP. (See Section VII.)

d. Projected threat. This optional appendix is prepared by the evaluator and defines the approved threat in the post-IOC timeframe of the tested system and includes capabilities, typical means of operation, and known methods of defeating the system. If a large amount of detail or more detail is required to adequately understand the threat, a lengthy threat statement can be included as appendix D. Appendix D is optional if the details

can be adequately covered in the threat paragraph of the TEP. See Section VII and Part One for threat details.

e. A copy of the DAG Charter and SOP is included by the evaluator if requirements for a DAG are specified in chapter 2 of the TEP. Details for the preparation of a DAG charter and SOP are contained in chapter 5. For abbreviated evaluations and for tests of combat/training developments, the tester may charter a DAG and add this appendix. When the need for a DAG is identified by either the tester or the evaluator, its mission and responsibilities are defined in this appendix.

f. A copy of the most recent and approved OTP referenced in appendix A is included as appendix F by the tester. Where appropriate, a test resume sheet (TRS) may be substituted for the OTP. (See chapter 4.)

g. The POA is the tester's detailed refinement of each operational test issue and associated criteria into OTMOPs and data elements. It should be developed as the first step in the preparation of the test design for all tests. (See Section XVI for POA requirements and instructions.)

h. Test scenario(s). This optional appendix contains details of the test scenario not contained in the main body of the document. (See Section XXVII for details.)

i. Test threat. This optional appendix contains details of threat portrayal not contained in the main body of the document. (See Section XXVII for details.)

j. Control concept appendix includes descriptions of the control structure and procedures that will be used to ensure that required test events occur in situations that realistically depict the tactical context of the test in accordance with the OMS. (See Sections XXIII and XXVII and chapter 5 for details.) The control concept is a preview of the Control Plan in the DTP and consists of three parts:

(1) Level of operational realism. The choice among the three levels of operational realism should be stated along with a short rationale for the choice. This may be dictated by the TSP.

(2) Synopsis of events. A very short overview of the proposed test events and the environment and sequence in which they will occur.

(3) Synopsis of control methods. An overview of the methods to be employed in causing the test events to happen.

k. Data management concept appendix outlines the test organization and responsibilities for data management. The data management concept is a preview of the Data Management Plan of the DTP. (See Sections XXIV and XXVII and chapter 5 for details.) The following information is to be included.

(1) Collection methods. Each method of data collection intended for the test is identified. Under each method is listed the general categories of data it will be used to collect.

(2) Collection support. Any special requirements pertaining to data collection are identified. Examples include an overview of test organization and planned initial quality control procedures, instrumentation requirements, data collectors with special qualifications, expected security and special data handling requirements, or video and photography documentation.

(3) Reduction methods. The concept through which recorded test data is organized, reduced, verified, managed, controlled, and stored. Each data requirement and its means of collection are delineated in the body of the TEP.

(4) Data presentation. Identify the concept for data display requirements including both management displays and test report displays.

(5) Data base design. Describe the concept for structure and content of the automated data base. If available at this time, the description of the test data base will include:

(a) Identification of the required files to include labels, a short description of the type of data to be stored in each file, and an indication for each file whether it is to be automated.

(b) A description of the architecture used to organize the data base.

(c) Definition of data elements in each file to include sufficient definitions to preclude misunderstanding and ambiguity (Data Element Dictionary).

(6) Data base management paragraph delineates the procedures for accessing and changing the data base. The activities or individuals who can query, manipulate, view, or modify all or part of the data base or other test results will be delineated. The authority to release all or part of the data will also be specified.

(7) Quality control concept paragraph outlines the concept for independently validating test data. It defines the checks and procedures which are to be used by the tester to preclude or detect and correct errors made in data collection, data entry, or data reduction.

l. ITTS support concept. This optional appendix contains details of planned ITTS not contained in the main body of the document. It is expanded into an ITTS Support Plan in the DTP. (See chapter 5.)

m. Audiovisual support concept. This optional appendix contains details of planned audiovisual support not contained in the main body of the document. It is expanded into an Audiovisual Support Plan in the DTP. For full evaluation systems audiovisual coverage is required. (See chapter 5.)

n. ADP support concept. This optional appendix contains details of planned ADP support not contained in the main body of the document. It is expanded into an ADP Support Plan in the DTP. (See chapter 5.)

o. The training concept is actually developed during the evolution of the control and data management plans. It is expanded into a Training Plan in the DTP. (See Sections XXV and XXVII and chapter 5 for details.) The following guidance should be considered for each group to be trained:

(1) Training of player personnel will provide individual, section, and unit level skills necessary to operate and maintain the equipment or perform the tactics to be tested.

(2) In those tests where OPFOR personnel is included, the units portraying the enemy must be trained to employ the tactics of the threat force. The employment of U.S. tactics and procedures by OPFOR may invalidate or cast doubts on results of such a test.

(3) As a minimum, controllers must be familiar with the control plan and the data management plan. They must be capable of making sound independent decisions on control matters in the absence of communications and should be able to act as data collectors should the need arise. They should also be able to implement emergency procedures.

(4) Training for data collectors will include instruction on the control plan and the data management plan. Particular emphasis should be given to the need for accuracy and unbiased

objectivity. Data collectors should be able to act as controllers and implement emergency procedures, if necessary.

(5) Training for data reducers and quality control personnel will provide familiarity with the data management plan and quality control procedures. Formal instruction is usually necessary, and training time and other resources must be planned accordingly. Practical exercises with substitute data will provide the best preparation.

(6) Test directorate and DAG personnel will be completely familiar with all aspects of the test. Some formal instruction is usually necessary, and training time and other resources must be planned accordingly.

p. Test support concept. This optional appendix contains details of planned test support equipment and facilities not contained in the main body of the document. It is expanded into a Test Support Plan in the DTP. (See chapter 5.)

(1) Test support addresses the categories of general administrative, materiel, and service support necessary for the performance of overall test activities. It includes general support functions to support both field testing and garrison administrative requirements.

(2) As for the other support planning requirements, the details of test support requirements and planning are identified and documented during planning for the operations and data collection/reduction requirements.

(3) The test support plan describes the requirements for items including but not limited to: equipment (vehicles including rental cars, generators, heating and air conditioning, special fabrication items; locally procured equipment such as copying machines and other office equipment, military standard items); facilities and base support (including offices, shelters, latrines, electricity, telephones and other communications equipment, signs, and any necessary range construction); supplies; ammunition; and fuel (MOGAS, JP-4, diesel). Schedules are developed for delivery of test support items and the use of facilities, ranges, and equipment.

(4) The safety plan section describes the procedures used to ensure safe conduct of the test to include a safety briefing (usually given by the chief controller) to all player and test directorate personnel based on the system safety release. In particular, it identifies required safety officers, and specifies procedures to ensure that operators of any potentially hazardous

equipment are fully trained. Tests posing unusual or potentially hazardous conditions that involve risk beyond the normal call of duty require approval by the Surgeon General and are to be conducted within the provisions of AR 70-25. The system safety release is also included or referenced.

(5) The electronic warfare plan is a detailed set of instructions, procedures, and schedules for those portions of the test involving electronic warfare. It is applicable when electronic warfare is a major condition of the test but not the purpose or major objective.

(6) The visitor control instructions document requirements for visitor control, briefings, security clearance verifications, conferences, field tours, transportation, special equipment (such as laser goggles, boots, and field pants), and other related details.

(7) The public affairs plan describes the measures to process requests or actions from the news media and local populace. Paragraph 3-29, AR 360-5, sets the Army policy on media coverage of Army test activities. It states: "The Department of the Army does not permit media coverage of developmental, technology validation, or operational testing of Army systems." Consult with the local public affairs officer for details.

(8) The OPSEC plan addresses the sensitive aspects for the test, the hostile threat, the vulnerabilities, countermeasures, OPSEC training, and priorities of the test. If appropriate for the test's classification, the test officer must plan for the protection of such information as communications (document or electronic means), informative patterns and signatures (visual, acoustic, electronic, or infrared), and stereotyped procedures (tactical, physical, or administrative).

(9) The security plan encompasses all activities required to ensure internal physical security at the headquarters area and the security of the test site along with their associated property to include the tested system. Coordinate this plan with your security manager. The security manager should also be consulted on access badges and security clearances.

q. A copy of the approved Test Environmental Assessment (TEA) is included by the tester.

r. A copy of the approved Environmental Impact Statement (EIS) is included by the tester. Planning for reduction of impact on the environment must be conducted for all tests in

which, as a result of test requirements, a potential for harm to the environment exists. This planning is test dependent but generally concerns areas of land, water, and air use or endangerment of animals, birds, or water life. In many cases, a formal environmental impact statement or environmental assessment must be obtained before the test can be conducted. The test officer should identify as early as possible whether a requirement for an environmental assessment exists and coordinate an initial determination of actions. The environmental assessment and procedures to be employed during the test to reduce environmental impacts, if required, are documented in the EIS with appropriate information brought forward to chapter 3 of the TEP.

s. DOTE approval of the test concept is required for TEP for all DOTE oversight programs. The evaluator will insert a copy of the formal DOTE approval of the test concept. (See Paragraph 3-13 and Part One.)

t. Test change proposals (TCP). This required appendix is added as a placeholder by the tester. As TCP are developed during the time between approval of the TEP and the end of the test, they are added in chronological sequence as tabs the appendix and are listed in the body of the appendix.

(1) TCPs are required for any changes to an approved TEP. A TCP will be initiated any time a change to the approved TEP is proposed by the tester, evaluator, or other official. It will outline the details of the proposed change and estimate the impact on test resources.

(2) TCPs for TEPs for full evaluate level systems will be submitted in the format shown in figure 3-43. TCPs for TEPs for other than full evaluate level systems will be submitted in the format shown in figure 3-44. Attachments to the TCP should consist of changed pages to be inserted in the TEP, changed cost estimates, or other material as appropriate to document the recommended change.

(INSERT FIGURE 3-43)

(INSERT FIGURE 3-44)

(3) The change should not be implemented until approved, but approval of immediate TCP requirements need not wait for formal documentation. The test directorate should notify the appropriate personnel that a TCP is required and the reason for the requirement. This should be performed telephonically or electronically (e.g., by e-mail). Necessary action to obtain

verbal or conditional approval can be performed based upon this early notification. Formal documentation can be prepared as required.

(4) Approval authority for the TCP is the same level as for the TEP.

(5) If possible, concurrence of the tester and evaluator, if appropriate, should be obtained on the TCP itself. A method of accomplishing this is shown in figure 3-45. This block should be inserted in the coordination paragraph of the TCP just prior to the approval block.

(INSERT FIGURE 3-45)

u. Glossary, Acronyms, and Abbreviations appendix is prepared as required by the evaluator and the tester. Any unusual technical terms or frequently used acronyms and abbreviations in the body of the TEP or in other appendixes will be defined in this appendix by the evaluator for his portion of the TEP and by the tester for those terms which he has introduced and which were not previously defined by the evaluator.

v. TEP coordination record is a listing of agencies with which the TEP was coordinated and a record of the resolution of their comments. (See Paragraphs 3-12 and 3-16.)

w. For historical purposes, all authors and supporting personnel having input to or knowledge of the writing of the TEP should be listed in this appendix by the evaluator.

x. Distribution of the TEP by organization and number of copies is shown in this appendix by the evaluator. (See Paragraphs 3-12 and 3-16.)

3-220. Documentation of appendixes
Appendixes are included in the TEP as shown in figure 3-46.

(INSERT FIGURE 3-46)

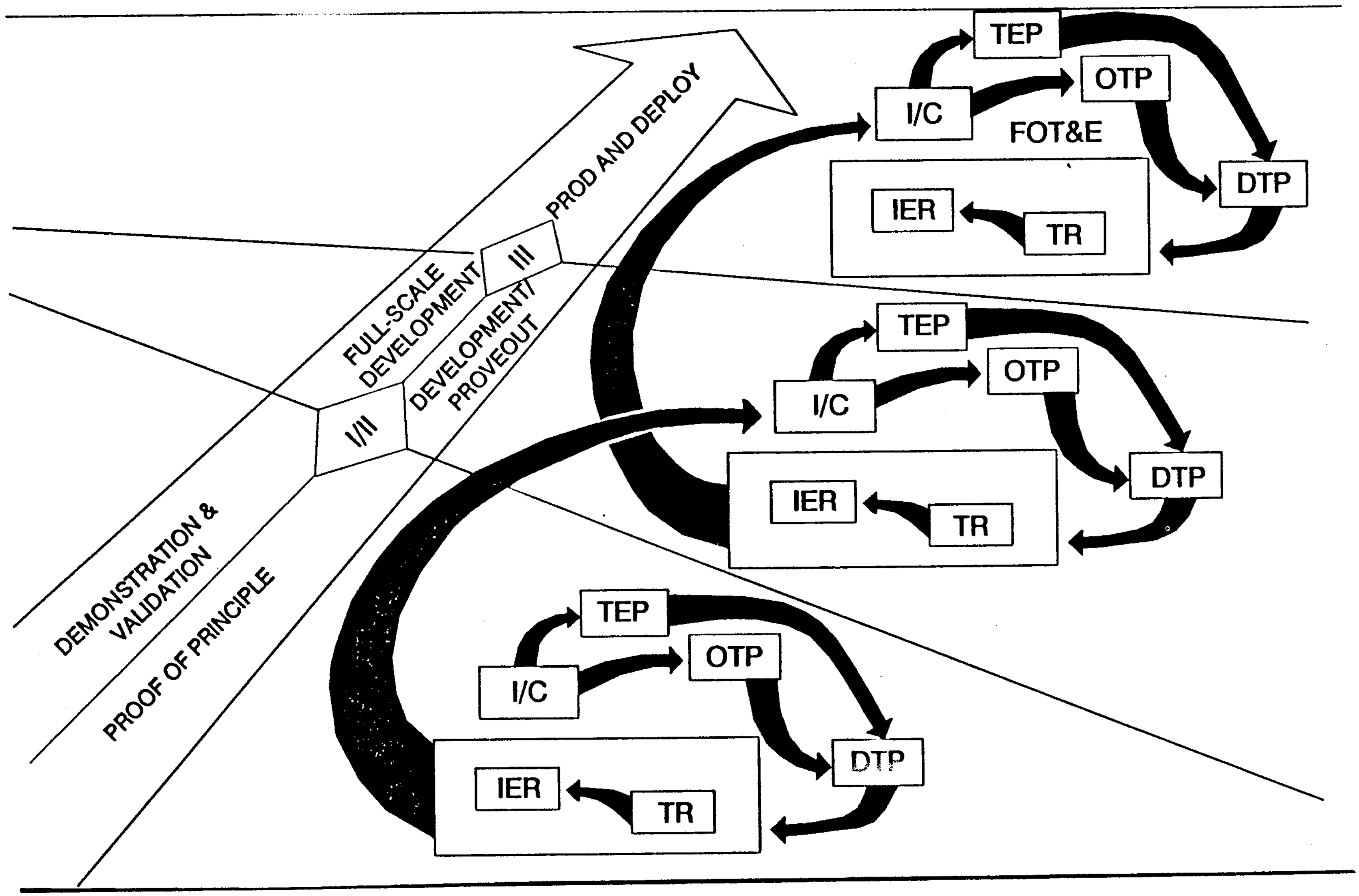


Figure 3-1. Operational test and evaluation cycle.

TEST AND EVALUATION PLAN (TEP) FORMAT

CHAPTER 1. INTRODUCTION
- 1.1. Purpose of the Evaluation
- 1.2. Scope of the Evaluation
- 1.3. Background
  - 1.3.1. Program Background
  - 1.3.2. Test and Evaluation Background
  - 1.3.3. COEA/OTE Relationship
- 1.4. System Description
- 1.5. Projected Threat
- 1.6. Test and Evaluation Milestones
- 1.7. Operational Issues and Criteria (OIC)
  - 1.7.1. COIC
    - 1.7.1.1. COIC 1 Issue Statement
      - 1.7.1.1.1. COIC 1 Scope
      - 1.7.1.1.2. COIC 1 Criteria
      - 1.7.1.1.3. COIC 1 Rationale
    - 1.7.1.2. COIC 2
      through
    - 1.7.1.m. COIC m
  - 1.7.2. AOIC
    - 1.7.2.m+1. AOIC m+1 Issue Statement
      - 1.7.2.m+1.1. AOIC m+1 Scope
      - 1.7.2.m+1.2. AOIC m+1 Criteria
      - 1.7.2.m+1.3. AOIC m+1 Rationale
    - 1.7.2.m+2. AOIC m+2
      through
    - 1.7.2.n-m. AOIC n
  - 1.7.3. Baseline Correlation Matrix (BCM)

CHAPTER 2. EVALUATION PLAN (ANALYSIS PLAN)
- 2.1. Evaluation/Analytic Approach
  - 2.1.1. Overview of Evaluation (Analytic) Approach
  - 2.1.2. Aggregation of Operational Effectiveness
  - 2.1.3. Aggregation of Operational Suitability
- 2.2. Operational Issues (from 1.7)
  - 2.2.1. Issue 1
    - 2.2.1.1. Criterion 1-1
      - 2.2.1.1.1. MOE/MOP 1-1-1
        - a. Analytic Design
        - b. Analytic Procedures
        - c. Presentations
      - 2.2.1.1.2. MOE/MOP 1-1-2
        through
      - 2.2.1.1.x. MOE/MOP 1-1-x
      - 2.2.1.1.x+1. Criterion Analytic Summary

Figure 3-2. TEP format

TEST AND EVALUATION PLAN (TEP) FORMAT (continued)

    2.2.1.2. Criterion 1-2
      through
    2.2.1.y. Criterion 1-y
    2.2.1.y+1. Issue Analytic Summary
  2.2.2. Issue 2
    through
  2.2.n. Issue n
2.3. Data Source Matrix (DSM)
2.4. User Test Approach
  2.4.1. Test Scope
  2.4.2. Factors and Conditions
  2.4.3. Test Design Matrix(es)
  2.4.4. Sample Sizes
  2.4.5. Requirements for a DAG
2.5. Other Sources of Data
  2.5.1. Other User Test (Repeat as necessary)
    2.5.1.1. Test Scope
    2.5.1.2. Factors and Conditions
  2.5.2. DT or Contractor Test (Repeat as necessary)
    2.5.2.1. Test Scope
    2.5.2.2. Factors and Conditions
  2.5.3. Modeling/Simulation (Repeat as necessary)
    2.5.3.1. Model (Simulation) Description
    2.5.3.2. Verification and Validation
    2.5.3.3. Accreditation
  2.5.4. Market Survey/Investigation
  2.5.5. Other Studies or Analyses
2.6. Data Base Structure
  2.6.1. Identification of Required Files
  2.6.2. Description of File Relationships
  2.6.3. Data Element Definitions
2.7. Evaluation Limitations

Figure 3-2. TEP format (cont)

TEST AND EVALUATION PLAN (TEP) FORMAT (continued)

CHAPTER 3. TEST DESIGN
- 3.1. Test Description
  - 3.1.1. Test Purpose
  - 3.1.2. Test Authority
  - 3.1.3. Test Overview
    - 3.1.3.1. Test Phases
    - 3.1.3.2. Factors and Conditions
- 3.2. Conduct of Test
  - 3.2.1. Tactical Context
    - 3.2.1.1. Scenario(s)
    - 3.2.1.2. Test Environment
    - 3.2.1.3. Threat for Test
    - 3.2.1.4. Tactics and Doctrine
    - 3.2.1.5. Test Unit Organization
  - 3.2.2. Test Events
    - 3.2.2.1. Mission and Vignette/Battle Description
    - 3.2.2.2. Site Specific Vignettes/Battles
    - 3.2.2.3. Vignette/Battle List
    - 3.2.2.4. Event Matrix(ces)
    - 3.2.2.5. Event Sequencing
  - 3.2.3. Control Procedures
  - 3.2.4. Schedule of Events
  - 3.2.5. Overall Methodology
  - 3.2.6. Test Limitations
- 3.3. Test Details
  - 3.3.1. Issue 1
    - 3.3.1.1. OTMOP 1-1
      - a. Methodology (OTMOP Peculiar)
        - (1) Test Events
        - (2) Control Concepts
      - b. Data Requirements (OTMOP Peculiar)
      - c. Data Collection (OTMOP Peculiar)
      - d. Data Reduction (OTMOP Peculiar)
      - e. Data Analysis (OTMOP Peculiar)
    - 3.3.1.2. OTMOP 1-2
      through
    - 3.3.1.x. OTMOP 1-x
  - 3.3.2. Issue 2
    through
  - 3.3.n Issue n

Figure 3-2. TEP format (cont)

TEST AND EVALUATION PLAN (TEP) FORMAT (continued)

3.4. Test Data Management
  3.4.1. Data Collection Concept
  3.4.2. Data Reduction Concept
  3.4.3. Quality Control Concept
  3.4.4. Data Reduction Timelines
  3.4.5. Data Base Design
    3.4.5.1. Data Element Dictionary
    3.4.5.2. Data Base Structure
    3.4.5.3. Data Collection Forms Matrix
3.5. Test Personnel, Equipment, and Materials
  3.5.1. Test Directorate Organization
  3.5.2. Training
    3.5.2.1. Test Player Personnel
    3.5.2.2. Test Directorate Personnel
  3.5.3. Equipment and Materials
    3.5.3.1. Instrumentation
    3.5.3.2. Targets and Simulators
    3.5.3.3. ADP Equipment
    3.3.3.4. Audiovisual Support
    3.3.3.5. Test Support Equipment
    3.3.3.6. Test Support Facilities
3.6. Environmental and Energy Impacts

Figure 3-2. TEP format (cont)

TEST AND EVALUATION PLAN (TEP) FORMAT (continued)

APPENDIXES

- APPENDIX A. Supporting Documentation
- APPENDIX B. Background--OPTIONAL
- APPENDIX C. System Description--OPTIONAL
- APPENDIX D. Projected Threat--OPTIONAL
- APPENDIX E. DAG Charter and SOP--Required if DAG is called for in paragraph 2.4.5. of the TEP
- APPENDIX F. Outline Test Plan (OTP)
- APPENDIX G. Pattern of Analysis
- APPENDIX H. Test Scenarios--OPTIONAL
- APPENDIX I. Test Threat--OPTIONAL
- APPENDIX J. Control Concept
- APPENDIX K. Data Management Concept
- APPENDIX L. Instrumentation, Targets, and Threat Simulators Support Concept--OPTIONAL
- APPENDIX M. Audiovisual Support Concept-OPTIONAL
- APPENDIX N. ADP Support Concept
- APPENDIX O. Training Concept
- APPENDIX P. Test Support Concept
- APPENDIX Q. Test Environmental Assessment
- APPENDIX R. Environmental Impact Statement
- APPENDIX S. DOT&E Test Concept Approval
- APPENDIX T Test Change Proposals
  - TAB 1. Test Change Proposal #1
    through
  - TAB n. Test Change Proposal #n
- APPENDIX U. Glossary, Acronyms, and Abbreviations
- APPENDIX V. TEP Coordination Record
- APPENDIX W. Authors and Supporting Personnel
- APPENDIX X. TEP Distribution List

Figure 3-2. TEP format (cont)

TEST AND EVALUATION PLAN (TEP)
PREPARATION RESPONSIBILITIES MATRIX

TYPE OF TEST/MANAGEMENT LEVEL OF SYSTEM

TEP Section	Full Eval	Abrv Eval	Prop FDTE	CEP Test	Cust Test	Eval Only
CHAPTER 1	E	TEI	TUI	TUI	TUI	E
1.1 Purpose	E	TEI	TUI	TUI	TUI	E
1.2 Scope	E	TEI	TUI	TUI	TUI	E
1.3 Background	E	TEI	TUI	TUI	TUI	E
1.4 Sys Descript	E	TEI	TUI	TUI	TUI	E
1.5 Proj Threat	EUI	TUI	TUI	TUI	TUI	EUI
1.6 T&E Milestones	ETI	TEI	TUI	TUI	TUI	E
1.7.1 COIC	EUI	TUI	TUI	TUI	TUI	EUI
1.7.2 AOIC	E	TEI	TUI	TUI	TUI	E
1.7.3 BCM	E	NR	NR	NR	NR	E
CHAPTER 2	E	T	T	T	T	E
2.1 Eval/Anal Approach	E	T	T	T	T	E
2.2 Operational Issues	E	T	T	T	T	E
2.3 Data Source Matrix	E	NR	NR	NR	NR	E
2.4 User Test Aproach	E	NR	NR	NR	NR	NR
2.5 Other Data Sources	E	NR	NR	NR	NR	E
2.6 Data Base Struc	E	NR	NR	NR	NR	E
2.7 Eval Limitations	E	NR	NR	NR	NR	E
CHAPTER 3	T	T	T	T	T	E
3.1 Test Description	T	T	T	T	T	NR
3.2 Conduct of Test	T	T	T	T	T	NR
3.3 Test Details	T	T	T	T	T	NR
3.4 Test Data Mgmt	T	T	T	T	T	NR
3.5 Pers-Equip-Matl	T	T	T	T	T	NR
3.6 Envir/Energy Impact	T	T	T	T	T	NR

Legend:
E = Evaluator, T = Tester, U = User, I = Input, NR = Not Required
Example: TEI = Tester responsibility, Evaluator Input.

Figure 3-3. TEP preparation matrix

APPENDIXES		T	T	T	T	T	E
A	Supporting Doc	E	T	T	T	T	E
B	Background (opt)	E	NR	NR	NR	NR	E
C	Sys Descript (opt)	E	T	T	T	T	E
D	Proj Threat (opt)	EUI	TUI	TUI	TUI	TUI	EUI
E	DAG charter and SOP	E	NR	TUI	NR	NR	NR
F	OTP	T	T	T	T	T	NR
G	Pattern of Analysis	T	T	T	T	T	NR
H	Test Scenarios (opt)	T	T	T	T	T	NR
I	Test Threat (opt)	T	T	T	T	T	NR
J	Control Concept	T	T	T	T	T	NR
K	Data Mgmt Concept	T	T	T	T	T	NR
L	ITTS Spt Concept	T	T	T	T	T	NR
M	A-V Spt Concept	T	T	T	T	T	NR
N	ADP Spt Concept	T	T	T	T	T	NR
O	Training Concept	T	T	T	T	T	NR
P	Test Spt Concept	T	T	T	T	T	NR
Q	Test Environ Assess	T	T	T	T	T	NR
R	Environ Impact State	T	T	T	T	T	NR
S	DOTE TC Approval	E	NR	NR	NR	NR	NR
T	Test Change Prop	TEI	T	TUI	TUI	TUI	NR
U	Glossary	E	T	T	T	T	E
V	TEP Coord Record	ETI	T	T	T	T	E
W	Authors	ETI	T	T	T	T	E
X	TEP Distrib List	ETI	T	TUI	TUI	TUI	E

Legend:
E = Evaluator, T = Tester, U = User, I = Input, NR = Not required
Example: TEI = Tester responsibility, Evaluator Input.

Figure 3-3. TEP preparation matrix (cont)

MILESTONES FOR FULL-EVALUATE LEVEL TEP DEVELOPMENT

Action	Resp	Desired	Latest
Draft COIC Submitted	CBTDEV	T-990	T-630
COIC Approved	TRADOC or DA	T-930	T-570
TEMP Approved	MATDEV or DOD	T-870	T-510
Draft TSP to Tester	CBTDEV TNGDEV MATDEV	ASAP	T-480
OTP Submitted to TEXCOM and Working Group TSARC	Tester	T-840	T-480
Draft TEP Ch 1 and 2 to Tester (Eval Dir Signature)	Eval	ASAP	T-435
OTP Submitted to OPTEC Working Group TSARC	OPTEC	T-750	T-390
OTP Submitted for GO TSARC Approval	OPTEC	T-720	T-360
Draft TEP Para 3.1 (Test Concept) to TEXCOM and OEC for Cmt	Tester	ASAP	T-285
Final TSP to Tester	CBTDEV TNGDEV MATDEV	ASAP	T-270
OTRR #1	Tester	T-270	T-270
Test Concept Pre-Brief to DUSA(OR)	OPTEC		T-26
Test Concept Briefing to DOTE	OPTEC		T-250
OEC Approved TEP Ch 1 and 2 (OEC Staffing Complete) Provided to Tester	Eval	ASAP	T-230

Figure 3-4. Milestones for Full Evaluate TEP Development

Action	Resp	Desired	Latest
Draft TEP Ch 3 to TEXCOM and OEC for Cmt	Tester	ASAP	T-230
Draft TEP Coord with TIWG Members	Tester	ASAP	T-200
TIWG Members Return Coord Draft Cmts	TIWG Members		T-180
Final Draft TEP to OEC/TEXCOM for Approval	Eval & Tester	ASAP	T-165
TEP Approved by OEC and TEXCOM	OEC & TEXCOM	ASAP	T-150
TEP Approved by OPTEC	OPTEC	ASAP	T-135
Brief Approved TEP to DUSA(OR)	OPTEC	T-130	T-130
Brief Approved TEP to DOTE	OPTEC	T-120	T-120
TEP to DOTE for Approval of Test Concept and Design	OPTEC	T-120	T-105
Draft DTP Complete	Tester	ASAP	T-90
Strawman TER Complete	Eval & Tester		T-90
OTRR #2	OPTEC	T-60	T-60
Final DTP Approval	TEXCOM	ASAP	T-45
Complete Pilot Test	Tester		T-3
OTRR #3	OPTEC	T-2	T-1
Test Start	Tester		T-Date

Figure 3-4 (cont). Milestones for Full Evaluate TEP Development

DISTRIBUTION LIST FOR TEPs
(Materiel Systems)

Agency	Number of copies per type TEP Draft TEP	Approved TEP
Deputy Under Secretary of the Army (Operations Research)	1	--
Operational Evaluation Command	2	2
Proponent	1	1
TSM	1	1
Coproponent	1	1
Project Manager	1	1
Materiel Developer	1	1
USA Air Defense Artillery School	1[a]	1[a]
USA Armor School	1[a]	1[a]
USA Aviation School	1[a]	1[a]
USA Chaplain Center and School	1[a]	1[a]
USA Chemical School	1[a]	1[a]
USA Field Artillery School	1[a]	1[a]
USA Engineer School	1[a]	1[a]
USA Infantry School	1[a]	1[a]
USA Army Institute of Pers and Resource Mgt	1[a]	1[a]
USA Intelligence Center and School	1[a]	1[a]
USA Intelligence School	1[a]	1[a]
USA Military Police School	1[a]	1[a]
USA Missile & Munitions Center & School	1[a]	1[a]
USA Ordnance Center and School	1[a]	1[a]
USA Quartermaster School	1[a]	1[a]
USA Signal School	1[a]	1[a]
USA Transportation School	1[a]	1[a]
USASSC and Fort Ben Harrison	1[a]	1[a]
USA Combined Arms Center and Ft Leavenworth	1[a]	1[a]
USA Logistics Center	1[a]	1[a]
TEXCOM		
Methodology and Analysis Directorate	2	1
Operations Directorate	1	--
Army Research Institute	1	1
AMC Liaison Office	1	1
Information Systems Directorate	1[a]	1[a]
Operations Support Directorate	1[a]	1[a]
Personnel, Admin, and Logistics Dir	1[a]	1[a]
Resource Management Directorate	1[a]	1[a]

[a]OPTEC evaluation/test directorates will determine if staffing is appropriate for each specific evaluation/test.

Figure 3-5. Distribution list for TEPs

DISTRIBUTION LIST FOR TEPs (cont)
(IMA Systems)

Agency	Number of copies per type TEP: Draft TEP	Approved TEP
Deputy Under Secretary of the Army (Operations Research)	1	--
Operational Evaluation Command	2	2
Proponent	1	1
Co-proponent (If applicable)	1	1
Project Manager	1	1
Materiel Developer	1	1
USA Air Defense Artillery School	1[a]	1[a]
USA Armor School	1[a]	1[a]
USA Aviation School	1[a]	1[a]
USA Chaplain Center and School	1[a]	1[a]
USA Chemical School	1[a]	1[a]
USA Field Artillery School	1[a]	1[a]
USA Engineer School	1[a]	1[a]
USA Infantry School	1[a]	1[a]
USA Army Institute of Pers and Resource Mgt	1[a]	1[a]
USA Intelligence Center and School	1[a]	1[a]
USA Intelligence School	1[a]	1[a]
USA Military Police School	1[a]	1[a]
USA Missile & Munitions Center & School	1[a]	1[a]
USA Ordnance Center and School	1[a]	1[a]
USA Quartermaster School	1[a]	1[a]
USA Signal School	1[a]	1[a]
USA Transportation School	1[a]	1[a]
USA Information Systems Command	1a	1a
USA Information Systems Engineering Command	1a	1a
USA Information Systems Support Center	1a	1a
USA Logistics Evaluation Agency	1a	1a
USASSC and Fort Ben Harrison	1[a]	1[a]
USA Combined Arms Center and Ft Leavenworth	1[a]	1[a]
USA Combined Arms Support Command	1[a]	1[a]
TEXCOM		
Methodology and Analysis Directorate	2	1
Operations Directorate	1	--
Army Research Institute	1	1
AMC Liaison Office	1	1
Information Systems Directorate	1[a]	1[a]
Operations Support Directorate	1[a]	1[a]
Personnel, Admin, and Logistics Dir	1[a]	1[a]
Resource Management Directorate	1[a]	1[a]

[a]OPTEC evaluation/test directorates will determine if staffing is appropriate for each specific evaluation/test.

Figure 3-5. Distribution list for TEPs (cont)

MILESTONES FOR ABBREV-EVALUATE LEVEL TEP DEVELOPMENT			
Action	Resp	Desired	Latest
Draft COIC Submitted	CBTDEV	T-990	T-630
COIC Approved	TRADOC or DA	T-930	T-570
TEMP Approved	MATDEV or DOD	T-870	T-510
Draft TSP to Tester	CBTDEV TNGDEV MATDEV	ASAP	T-480
OTP Submitted to TEXCOM and Working Group TSARC	Tester	T-840	T-480
AOIC and Evaluator Concerns Provided to Tester	Eval	ASAP	T-435
OTP Submitted to OPTEC Working Group TSARC	OPTEC	T-750	T-390
OTP Submitted for GO TSARC Approval	OPTEC	T-720	T-360
Draft TEP Para 3.1 (Test Concept) to TEXCOM for Cmt	Tester	ASAP	T-285
Final TSP to Tester	CBTDEV TNGDEV MATDEV	ASAP	T-270
OTRR #1	TEXCOM	T-270	T-270
Draft TEP Ch 3 to TEXCOM for Cmt	Tester	ASAP	T-230
Draft TEP Coord with TIWG Members and OEC	Tester	ASAP	T-200

Figure 3-6. Milestones for Abbrev Evaluate TEP Development

Action	Resp	Desired	Latest
TIWG Members Return Coord Draft Cmts	TIWG Members		T-180
Final Draft TEP to TEXCOM for Approval	Tester	ASAP	T-165
TEP Approved by TEXCOM	TEXCOM	ASAP	T-150
Draft DTP Complete	Tester	ASAP	T-90
Strawman TER Complete	Tester		T-90
OTRR #2	TEXCOM	T-60	T-60
Final DTP Approval	TEXCOM	ASAP	T-45
Complete Pilot Test	Tester		T-3
OTRR #3	TEXCOM	T-2	T-1
Test Start	Tester		T-Date

Figure 3-6 (cont). Milestones for Abbrev Evaluate TEP Development

STAFFING LIST FOR DRAFT AND APPROVED TEPs FOR OTHER THAN FULL-EVALUATE LEVEL TEPs

Agency	Number of copies per type TEP: Abbreviated evaluated Draft	Abbreviated evaluated Appr	FDTE Draft	FDTE Appr	CEP/CT Draft	CEP/CT Appr
Deputy Under Secretary of the Army (Operations Research)	--	--	--	--	--	--
Operational Evaluation Command	2	2	2[a]	2[a]	1[a]	1[a]
Proponent	1	1	1	1	1	1
TSM	1	1	1	1	1	1
Coproponent	1	1	1	1	1	1
Project Manager	1	1	1[a]	1[a]	--	--
Materiel Developer	1	1	1[a]	1[a]	1	1[a]
USA Air Def Artillery School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Armor School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Aviation School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Chaplain Center and School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Chemical School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Field Artillery School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Engineer School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Infantry School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Army Institute of Pers and Resource Mgt	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Intelligence Ctr & School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Intelligence School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Military Police School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Missile/Munitions Ctr/School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Ordnance Ctr and School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Quartermaster School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Signal School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Transportation School	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USASSC and Fort Ben Harrison	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Combined Arms Center and Fort Leavenworth	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
USA Logistics Center	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
TEXCOM						
Methodology and Analysis Dir	2	1	2	1	2	1
Operations Directorate	1	1[a]	1	1[a]	1	1[a]

Figure 3-7. Staffing list for draft and approved TEPs for other than full-evaluate level TEPs

Army Research Institute	1	1[a]	1	1[a]	1	1[a]
AMC Liaison Office	1	1[a]	1	1[a]	1	1[a]
Information Systems Dir	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
Operations Support Dir	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
Personnel, Admin, & Log Dir	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]
Resource Management Dir	1[a]	1[a]	1[a]	1[a]	1[a]	1[a]

[a]Test directorate or HQ TEXCOM will determine if staffing is appropriate for each specific test.

Figure 3-7. Staffing list for draft and approved TEPs for other than full-evaluate level TEPs (cont)

CHAPTER 1. INTRODUCTION (IOE responsibility). The format for this paragraph will be the same as for a regular TEP.

CHAPTER 2. EVALUATION PLAN (IOE responsibility). The format for this paragraph will be the same as for a regular TEP. In this paragraph, the evaluator must provide the test design concept (paragraph 2.4 of the TEP) to guide the development of the combined TT/OT test design.

CHAPTER 3. TEST PLAN (IOE responsibility) The IOE will write a brief (single paragraph) narrative of the combined TT/OT plan prepared by the technical tester in coordination with the operational tester. The narrative will conclude with the annotation that a copy of the test plan is at a designated appendix to the TEP.

APPENDIXES: As required.

Figure 3-8. TEP format for a combined technical test/operational test

CHAPTER 1. INTRODUCTION (IOE responsibility). The format for this paragraph will be the same as for a regular TEP.

CHAPTER 2. EVALUATION PLAN (IOE responsibility). The format for this paragraph will be the same as for a regular TEP. There will be no paragraph 2.4 since the evaluation plan in this TEP will not be the basis of any specific test design.

CHAPTER 3. TEST PLAN (IOE responsibility). The IOE will write a brief (single paragraph) narrative that summarizes the tests outlined as data sources in chapter 2. Copies of test plans, market survey or investigation plans, and modeling or simulation plans may be attached as needed. The narrative will conclude with the annotation that a copy of the test plan(s) is/are at designated appendix(es) to the TEP.

APPENDIXES: As required.

Figure 3-9. TEP format for an operational assessment based on other than a user test

CHAPTER 1. INTRODUCTION (IOE responsibility). The format for this paragraph will be the same as for a regular TEP.

CHAPTER 2. EVALUATION PLAN (IOE responsibility). The format for this paragraph will be the same as for a regular TEP.

CHAPTER 3. TEST PLAN-TEST A (tester A responsibility). The format for this paragraph will be the same as for chapter 3 of a regular TEP.

CHAPTER 4. TEST PLAN-TEST B (tester B responsibility). The format for this paragraph will be the same as for chapter 3 of a regular TEP.

APPENDIXES: The appendixes will be the same as for a regular TEP, but each tester must prepare tester appendixes for this test. Appendixes will be redesignated in a logical fashion.

NOTE: Chapter 3 may be repeated and renumbered accordingly for multiple tests.

Figure 3-10. TEP format for multiple user tests supporting a single evaluation

MATERIEL DEVELOPER SUPPORT PACKAGES	
System support package	Statement of maintenance procedures; draft equipment publications; repair parts, accessories; special and common tools; test support calibration and maintenance/calibration shop facilities; and personnel skill requirements.
New equipment training	A combination of documents, training aids, simulators, programs of instruction, and identification of personnel requirements to provide training to test participants and to assist the trainer in developing the system raining program.
COMBAT DEVELOPER AND TRAINER SUPPORT PACKAGES	
Doctrinal and organizational TSP	
Means of employment	Draft FMs; doctrinal employment task lists; statements of doctrine, tactics, and techniques.
Organization	Statement of MOS, basis of issue, unit structures, and lines of command or coordination for units employing the tested system.
Logistic concepts	Statement of applicable supply, transportation, and maintenance concepts and procedures for the tested system that is compatible with the system support package provided by the materiel developer.
Mission profiles	Statement of types of combat activities and the frequency of events (operational mode summary) in the combat missions in the form of either a set of alternate mission profiles or a typical profile, plus statistical distribution of frequency of events and estimated or actual duration times of events and time between events.

Figure 3-11. Test support packages

Test setting	Statement of plausible situation to show interaction among threat, friendly actions, and environment involving the tested system.
Threat support package	Statement of the potential threat in the initial operational capability (IOC) timeframe related to the tested system, included both capabilities, typical means of operating, and known methods of defeating the system.
Training support package	Conceptual course of instruction, training documents, (individual training plan, individual/collective training plan, training schedule, task inventories, ARTEPs, soldier manual, commander's training data collection requirements), and personnel selection criteria.

Figure 3-11. Test support packages (cont)

SYSTEM REQUIREMENT	REQUIREMENTS DOCUMENTS				
	NMS	SYSTEM SPECIFICATIONS	ORD	ISSUES AND CRITERIA	MEASURE OF EFFECTIVENESS
1.0 FIREPOWER	1.1 CAL probability of kill = .96 per enemy plane, when raid size is < 20 planes.	1.1 CAL probability of kill = .96 per enemy plane, when raid size is < 20 planes.	1.1 CAL probability of kill = .96 per enemy plane, when raid size is < 20 planes.	1.1 Issue: Does the CAL provide an improved capability to kill enemy planes? Criteria: CAL will have a probability of kill greater than or equal to .96 when raid size is less than or equal to 20 planes.	1.1 MOE: $Pk = \frac{\#K}{T\#TGTS}$ where #K is the number of enemy planes killed in a given battle sequence, and T#TGTS is the total number of targets available in a given battle sequence.
	1.2 CAL must have a firing rate of 1 round per launcher every 5 seconds.	1.2 CAL must have a firing rate of 1 round per launcher every 3 seconds.	1.2 CAL must have a firing rate of 1 round per launcher every 3 seconds.	1.2 Issue: Does CAL have an effective firing rate during a typical battle scenario? Criteria: CAL will have a firing rate of 1 round per launcher every 5 seconds.	1.2 MOE: MTT Launch $1 \text{ Round} = \frac{\sum_{i=1}^{n} DUREI}{\sum_{i=1}^{n} \#LI}$ DUREI = duration of engagement I #LI = # of launches for launcher 1 in engagement I
2.0 TARGET LOCATION	2.1 CAL must detect target with probability .91 at a distance of < 2 kilometers.	2.1 CAL must detect target with probability .91 at a distan~e of < 2 miles.	2.1 CAL must detect target with probability .91 at a distance of < 2 miles.	2.1 Issue: does the CAL accurately detect enemy targets in an operational environment? Criteria: CAL will detect an enemy target with probability greater than or equal to .91 when target is less than 2 miles out.	2.1 MOE: $P_D = \frac{\#D}{T\#TGTS}$ where #D is the number of enemy planes detected in a given battle sequence, and T#TGTS is the total number of targets available in a given battle sequence.

Figure 3-12. Example baseline correlation matrix.

SYSTEM REQUIREMENT	REQUIREMENTS DOCUMENTS				
	NMS	SYSTEM SPECIFICATIONS	ORD	ISSUES AND CRITERIA	MEASURE OF EFFECTIVENESS
	2.2 Given target detection, CAL must correctly identify target with probability .98.	2.2 Given target detection, CAL must correctly identify target with probability .98.	2.2 CAL must correctly identify target with probability .98.	2.2 Issue: Does CAL correctly identify targets in the field? Criteria: CAL will correctly identify 98 percent of the targets it detects.	2.2 MOE: $P_I = \frac{\#I}{\#D}$ where #I is the number of enemy planes identified in a given battle sequence, and #D is the number of enemy planes detected in a given battle sequence.
3.0 MOBILITY	3.1 CAL must have emplacement time of all sections < 45 minutes after alert.	3.1 CAL must have emplacement time of all sections < 45 minutes after alert.	3.1 CAL must have emplacement time of all sections < 45 minutes after alert.	3.1 Issue: Is the emplacement time for CAL in an operational environment adequate to support CAL's doctrine of employment? Criteria: CAL will have an emplacement time of less than or equal to 45 minutes for all sections.	3.1 MOE: $\text{MTT Emplace} = \frac{\sum_{i=1}^{n} ETI}{n}$ n = # of trials (emplacements or displacements) ETI = emplacement time for trial i
	3.2 CAL must have displacement time of all sections < 20 minutes after move order.	3.2 CAL must have displacement time of all sections < 20 minutes after move order.		3.2 Issue: Is the displacement time for CAL in an operational environment adequate to support CAL's doctrine of employment? Criteria: CAL will displace all of its sections within 20 minutes after move order.	3.2 MOE: $\text{MTT Displace} = \frac{\sum_{i=1}^{n} DTI}{n}$ DTI = displacement time for trial i
4.0 LOGISTICS	....	....	....	....	

Figure 3-12 (cont). Example baseline correlation matrix.

BCM Requirements

(1) An example BCM is shown in figure 4-4. This greatly simplified example tracks system requirements for the hypothetical "Cruising Air Launcher (CAL) Air defense System" over four requirements documents and highlights apparent discrepancies in values and wording of requirements. Figure 4-4 shows several different types of discrepancies that the BCM can help to uncover.

(a) Requirement 1.1 tracks through O&O plan, the system specifications, and the ROC. However, the MNS says"...< [less than] 20 enemy planes" and the other documents say"...≤ [less than or equal to] 20 enemy planes." Identify this type of discrepancy to the MNS author.

(b) Requirement 1.2 varies in the number of seconds from 5 seconds (in the O&O and MNS) to 3 seconds (in the system specifications and the ROC). This discrepancy may be justified, or it may be an error. Pursue this kind of discrepancy until it is resolved.

(c) Requirement 2.1 is stated in miles by three of the documents and in kilometers by the fourth (the MNS). There would be no discrepancy if the MNS required "3.2 kilometers," because 3.2 kilometers equals 2 miles. When the numbers are the same but the units of measure are different, however, the discrepancy must be resolved.

(d) Requirement 2.1 does not track because the opening phrase "Given target detection" is left out of the ORD requirement. This omission could be either an oversight or intentional. If the omission is intentional, the meaning changes entirely. Follow up and resolve the discrepancy.

(e) Requirement 3.2 does not appear in the ORD column, indicating that the requirement has disappeared in the course of the program. Follow up on why requirement 3.2 is no longer necessary, or ensure that it is otherwise accommodated.

(2) The example BCM in figure 4-2 shows sample I&C corresponding to the system requirements and the logical MOEs. These MOEs seem reasonable; however, one possible type of discrepancy that might typically occur is shown.

Figure 3-13. BCM requirements

(a) The discrepancy occurs between the probability of kill (Pk) requirement 1.1 and the probability of detection (Pd) requirement 2.1. The MOE for 1.1 is defined as Pk where Pk = #K / T#TGTS; and #K = the number of enemy planes killed by CAL in a given battle sequence; and T#TGTS = the total number of possible targets in a given battle sequence. The MOE for 2.1 is defined as Pd where Pd = #D / T#TGTS; and #D = the number of planes detected by CAL in a given battle sequence; and T#TGTS is the same total number of possible targets.

(b) Obviously, when Pk and Pd are defined in this manner, Pk must be less than or equal to Pd. However, the requirements documents state Pk $\geq$ .96, and Pd $\geq$ .91, so the evaluator must resolve the discrepancy. The Pk referred to is probably the Pk given a detection. The evaluator must ensure that this is in fact the requirement, and then the MOE is more specifically stated.

Figure 3-13. BCM requirements (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 1--INTRODUCTION

CHAPTER 1. INTRODUCTION. This chapter provides necessary information to understand the bases of both the test and of the evaluation. This chapter is prepared by either the evaluator or the tester depending on the type of test or evaluation. See figure 3-3 for allocation of responsibilities for the preparation of this chapter.

1.1. PURPOSE. State the purpose for conducting the evaluation and for planning the testing. State any decision supported by the evaluation and form an extent of evaluation or assessment. Identify all testing outlined in chapters 2 and 3 of the TEP.

1.2. SCOPE. Address the breadth of the data sources to be used to prepare the test and evaluation/assessment reports. Provide an overview relevant models, analyses, tests, equipment, and other resources which together are the basis for any planned evaluation or assessment.

1.3. BACKGROUND. Include the background of the system development and T&E of the system. If the details are so voluminous that continuity of the TEP is lost, they should be summarized here and stated in detail in appendix B. Appendix B is optional if the details can be adequately covered in this paragraph.

1.3.1. PROGRAM BACKGROUND. Include an overview of the program, its acquisition strategy, the system's anticipated use to the Army, and the deficiency identified in the Mission Area Analysis (MAA) that the system is to correct. Identify the next program decision to be supported by the testing and evaluation and the decision to be made.

1.3.2. TEST AND EVALUATION BACKGROUND. Include a summary of all OTE, DTE, and contractor test to date. Both the scope of T&E and the results of the T&E are to be included.

1.3.3. COEA/OTE RELATIONSHIP. Required for any system for which a COEA is done and OTE is conducted. Describe the linkage between the COEA and the planned results of OTE.

Figure 3-14. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 1

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 1--INTRODUCTION (cont)

1.4 SYSTEM DESCRIPTION. Include a description of the system (or combat/training development product). Describe the system and its major roles, missions, and components or characteristics. If more detail is required to adequately understand the system, a lengthy system description can be included as appendix C. Appendix C is optional if the details can be adequately covered in this paragraph.

1.5. PROJECTED THREAT. Define the approved threat in the post-IOC timeframe of the tested system and include capabilities, typical means of operation, and known methods of defeating the system. If more detail is required to adequately understand the threat, a lengthy threat statement can be included as appendix D. Appendix D is optional if the details can be adequately covered in this paragraph.

1.6. TEST AND EVALUATION MILESTONES. List all the milestones important to success or completion of T&E leading to a milestone decision review or other event supported by the T&E effort. The list may be incorporated as a part of the paragraph or may be called out in the paragraph and included as a table or a figure in the TEP.

1.7. OPERATIONAL ISSUES AND CRITERIA (OIC). List the OIC used to evaluate the system, construct an evaluation plan, and develop a test design for the system (or combat/training developments product). For materiel and IMA systems, break the OIC down into COIC (prepared by the CBTDEV/functional proponent and AOIC prepared by the evaluator. For T&E of CBTDEV or TNGDEV products, only OIC developed by TRADOC are required. COIC and AOIC collectively constitute the OIC for the TEP. Each issue must have at least one associated criterion. State each OIC set in full to include issue, scope, criteria, and rationale. The evaluator may add additional evaluator criteria to a critical issue. Criteria which are a part of the original COIC set will always have both a measure (parameter) and a threshold (value). Criteria developed by the evaluator may have only a measure. In those cases where the evaluator criterion lacks a threshold (value), the criterion will be labeled "investigative" and only the measure (parameter) specified.

Figure 3-14. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 1 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 1--INTRODUCTION (cont)

1.7.1. CRITICAL OPERATIONAL ISSUES AND CRITERIA (COIC). This paragraph contains the approved COIC which are directly extracted from the approved TEMP.

1.7.2. ADDITIONAL OPERATIONAL ISSUES AND CRITERIA (AOIC). This paragraph contains AOIC developed by the evaluator to complement and supplement approved COIC to completely address all aspects of system operational effectiveness and suitability.

1.7.3. BASELINE CORRELATION MATRIX (BCM). This paragraph calls out the BCM which is then included as a figure or table in the TEP on a facing page. A BCM is only required for full evaluation TEP. Instructions for the preparation of the BCM are contained in chapter 3.

Figure 3-14. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 1 (cont)

SAMPLE ISSUE AND CRITERIA SET

Issue. Is the *** system effective at determining prioritized target information to support *** in the close support role?

Scope. This issue addresses the speed and accuracy with which the *** system can search, detect, and locate heat emitting targets in the European theater. The probability of detecting a target will be examined based on the type target, IR cross section, *** system speed, search pattern and target density.

Criterion. The *** system must have a 90% chance of detecting threat vehicular targets within 2 minutes and locating them with a 25 meter CEP accuracy.

Rationale. ********

Figure 3-15. Sample issue and criteria set

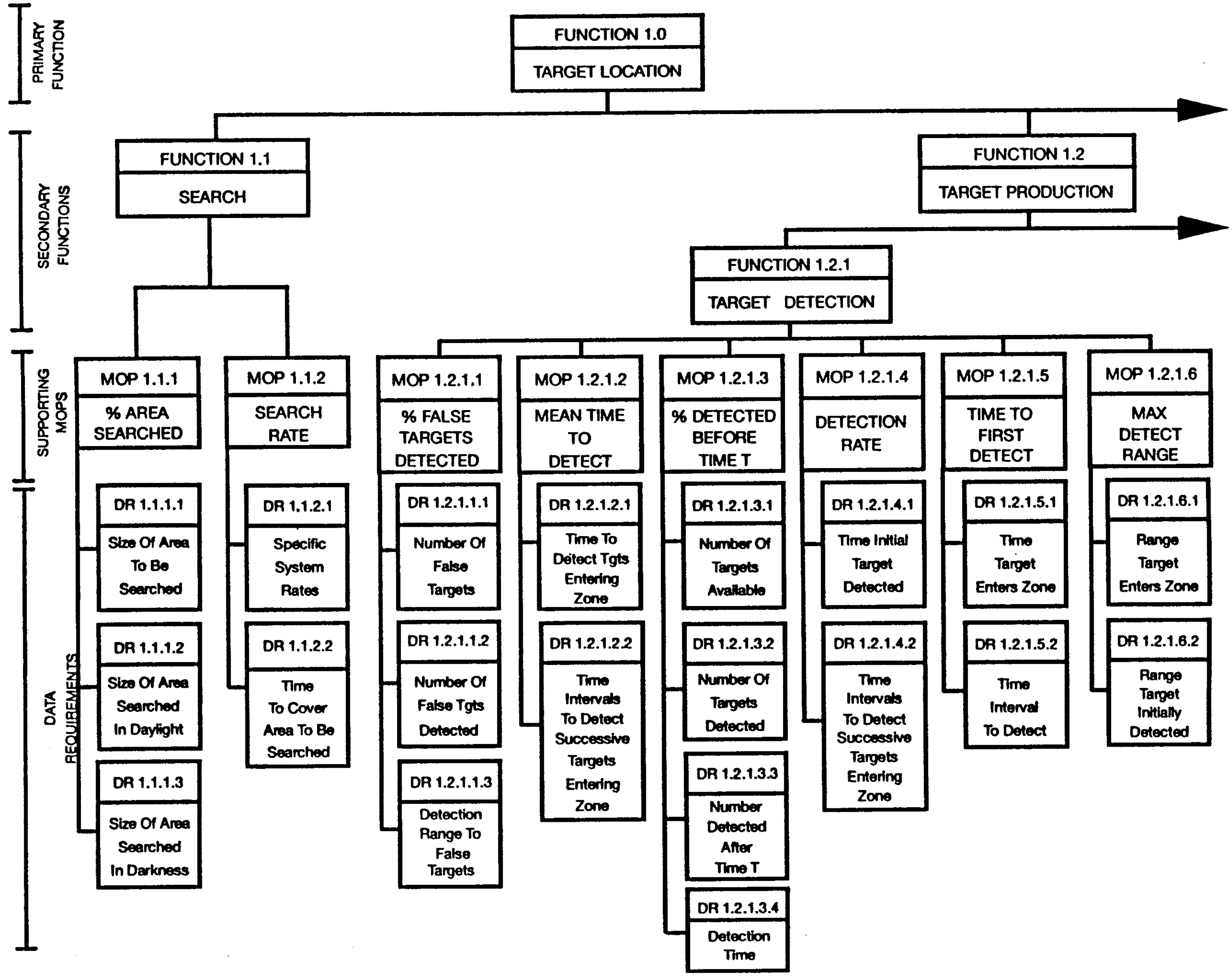


Figure 3-16. Example location function dendritic.

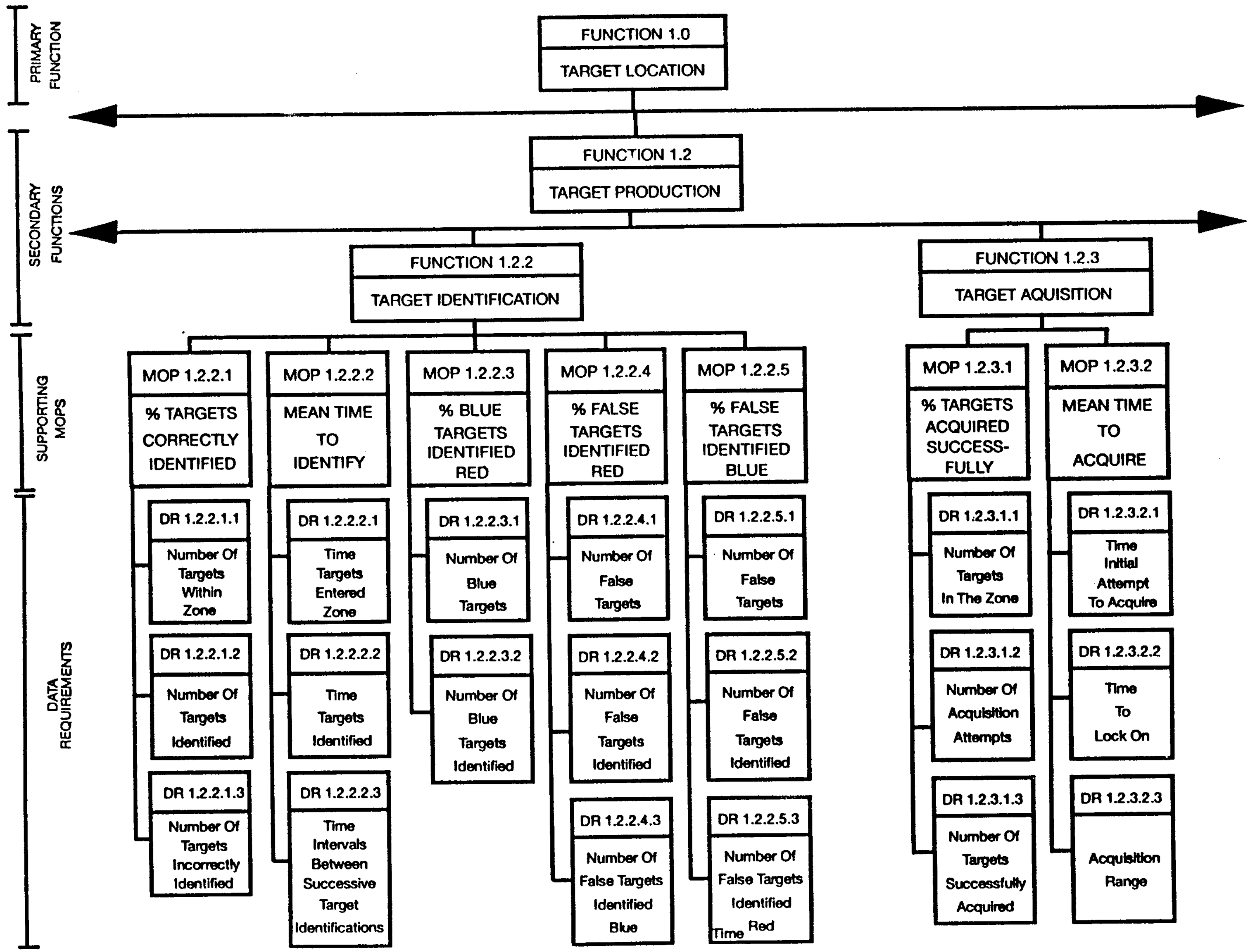


Figure 3-16 (cont). Example location function dendritic.

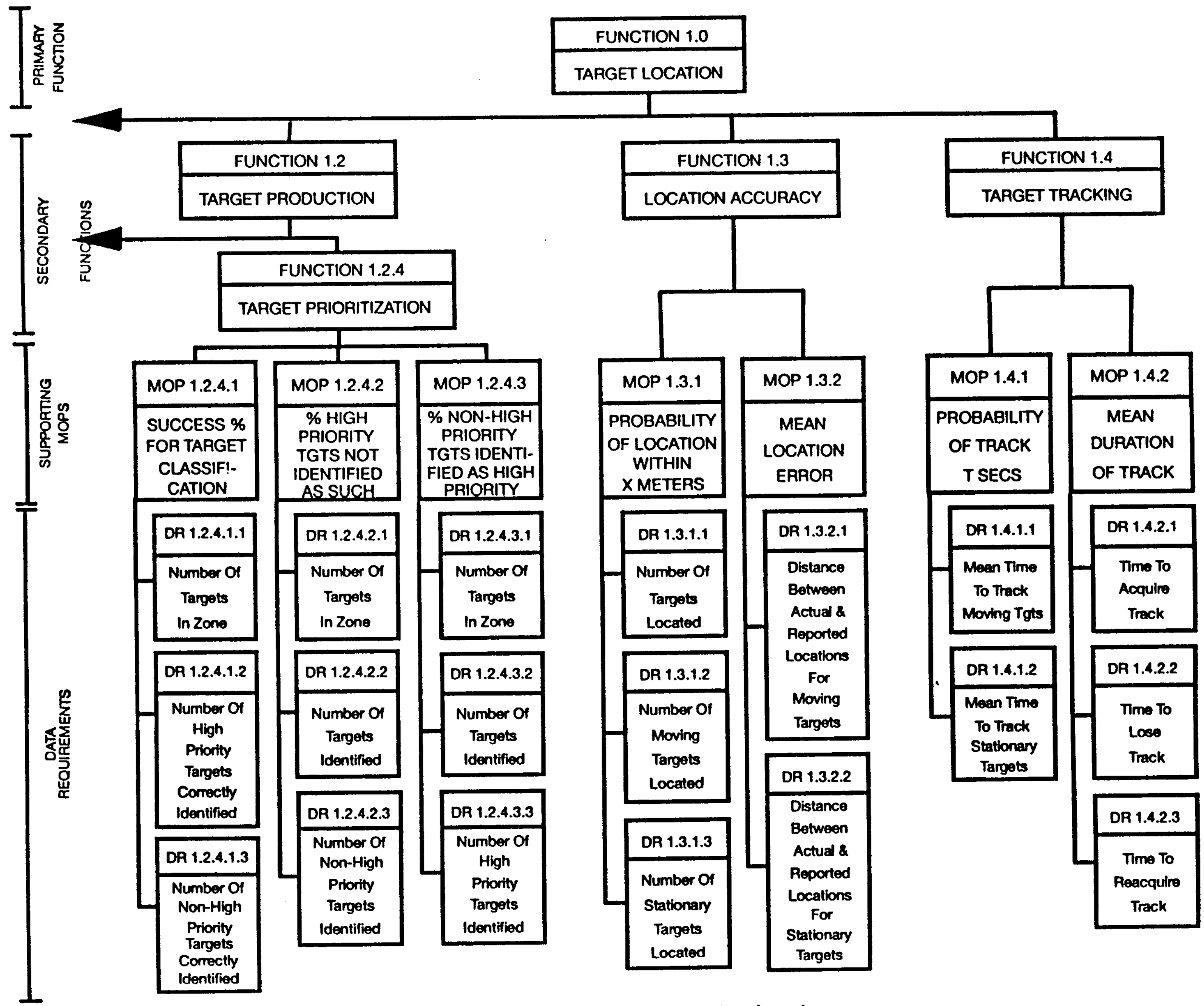


Figure 3-16 (cont). Example location function dendritic.

FACTORS AND CONDITIONS

FACTORS	CONTROL	CONDITIONS
Range of engagement	Systematically varied	100-500m, 501-900m, 900-1300m
Light conditions	Systematically varied	Day, night
Target movement	Systematically varied	Moving, stationary
Threat arrays	Systematically varied	IAW Threat Spt Package
NBC	Systematically varied	No MOPP, MOPP 2, MOPP 4
Terrain (phase I)	Systematically varied	Flat, rolling
Terrain (phase II)	Tactically varied	Rugged, swamp
Enemy action	Systematically varied	Attack, defend
Battlefield obscuration	Systematically varied	No smoke, smoke
EW environment	Systematically varied	IAW threat spt package
Personnel	Held constant	5th-95th percentile
Organization	Held constant	Battery level
Doctrine/tactics	Held constant	IAW D&O TSP
Logistics support	Held constant	ORG, DS
Communications status	Tactically varied	Radio-voice, radio-digital
Enemy target	Tactically varied	Troops, vehicle, bunker
Weather	Uncontrolled	Rain, dry, snow
System operating status	Uncontrolled	Fully opnl, degrade mob, degrade fipwr nonopnl

Figure 3-17. List of typical factors and conditions

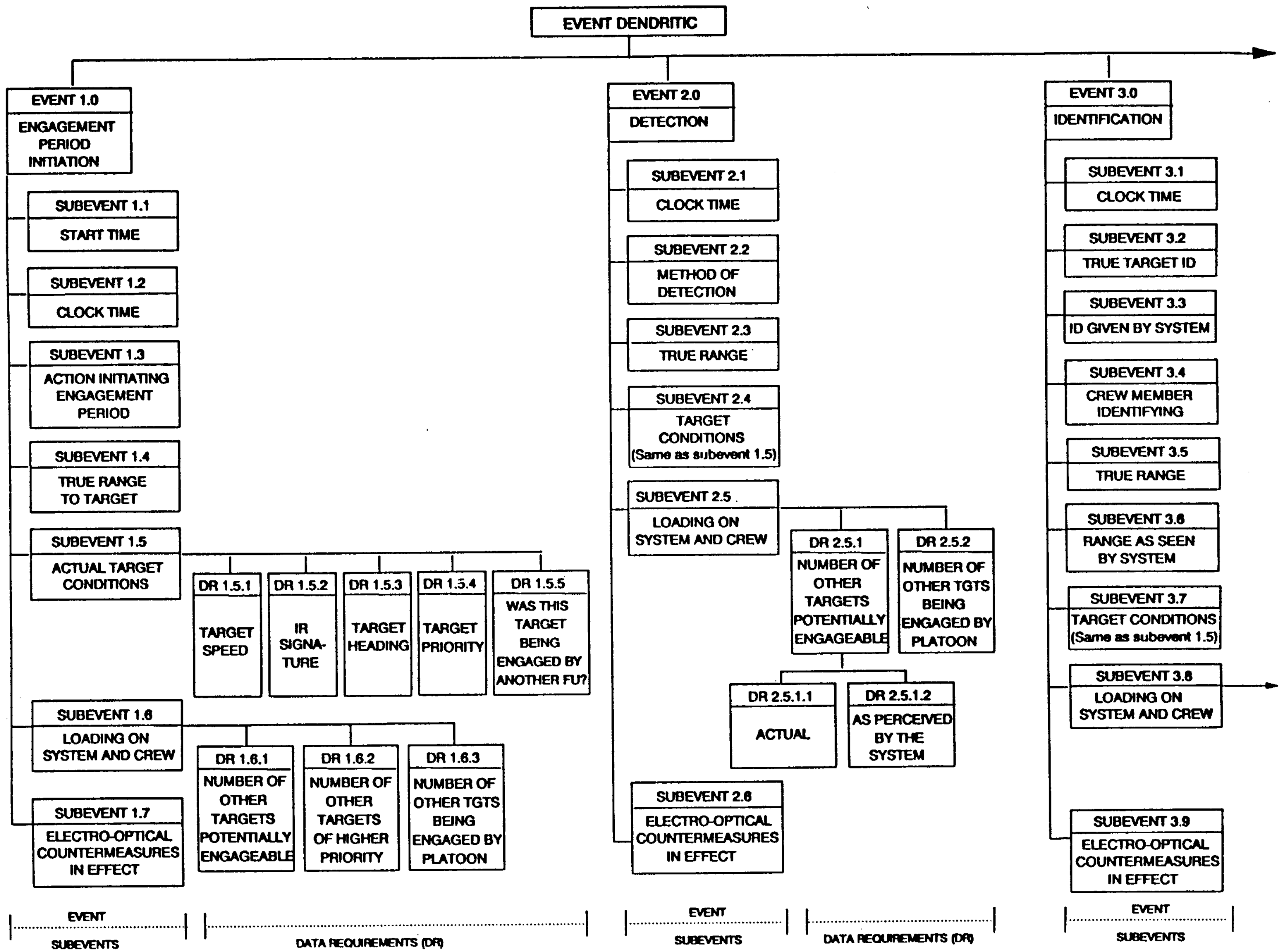


Figure 3-18. Example event dendritic.

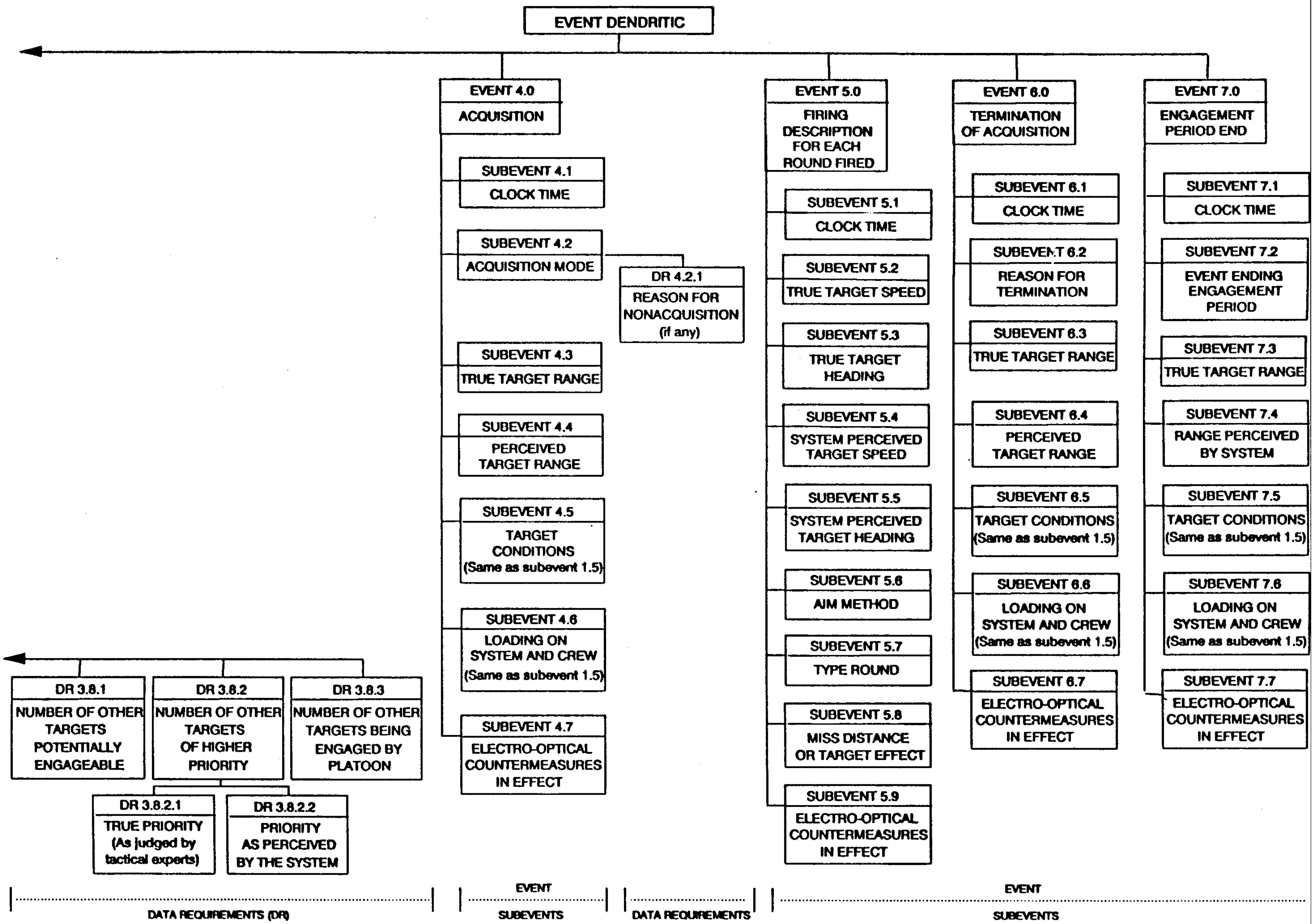


Figure 3-18 (cont). Example event dendritic.

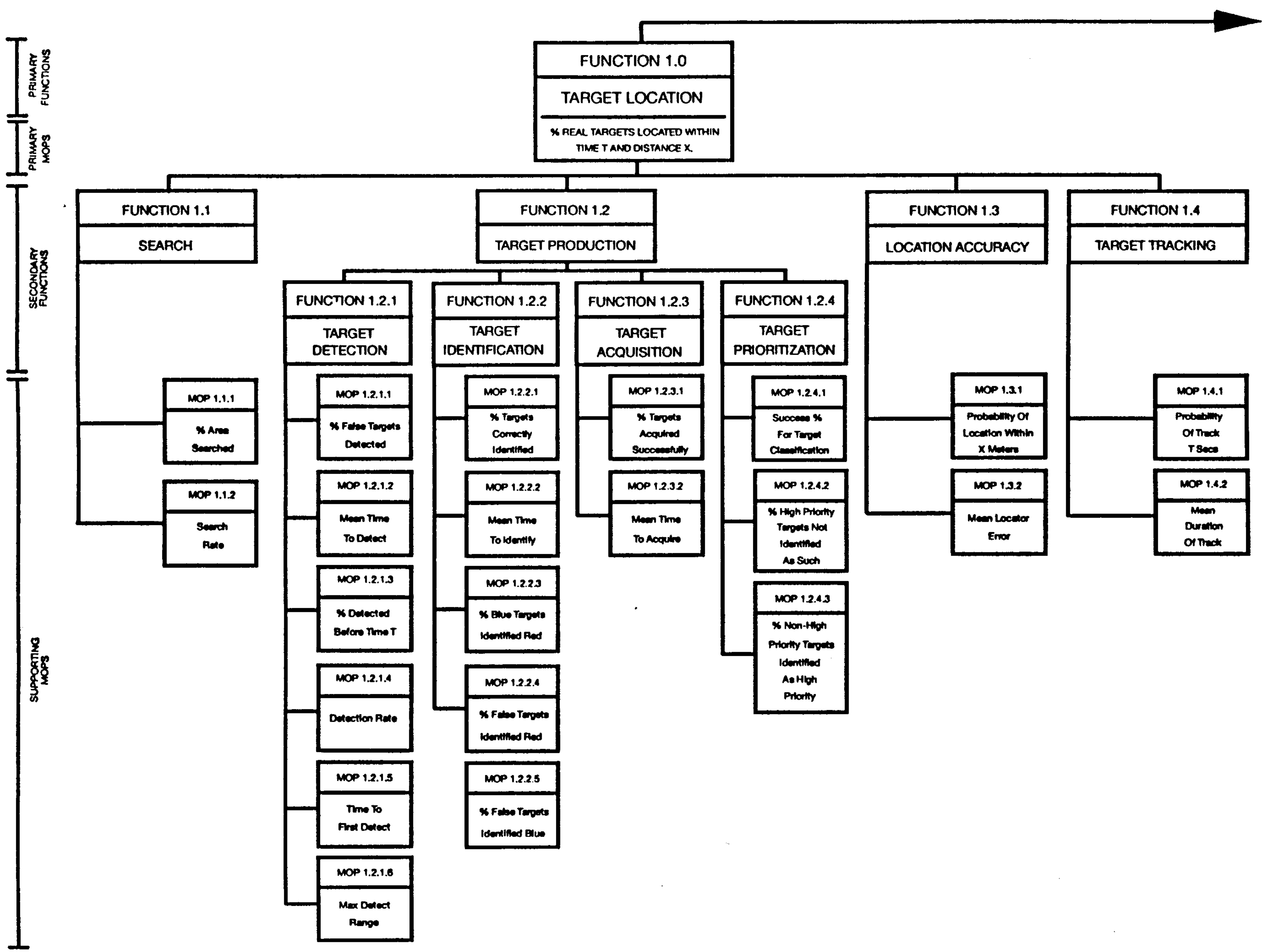


Figure 3-19. Example mission performance dendritic.

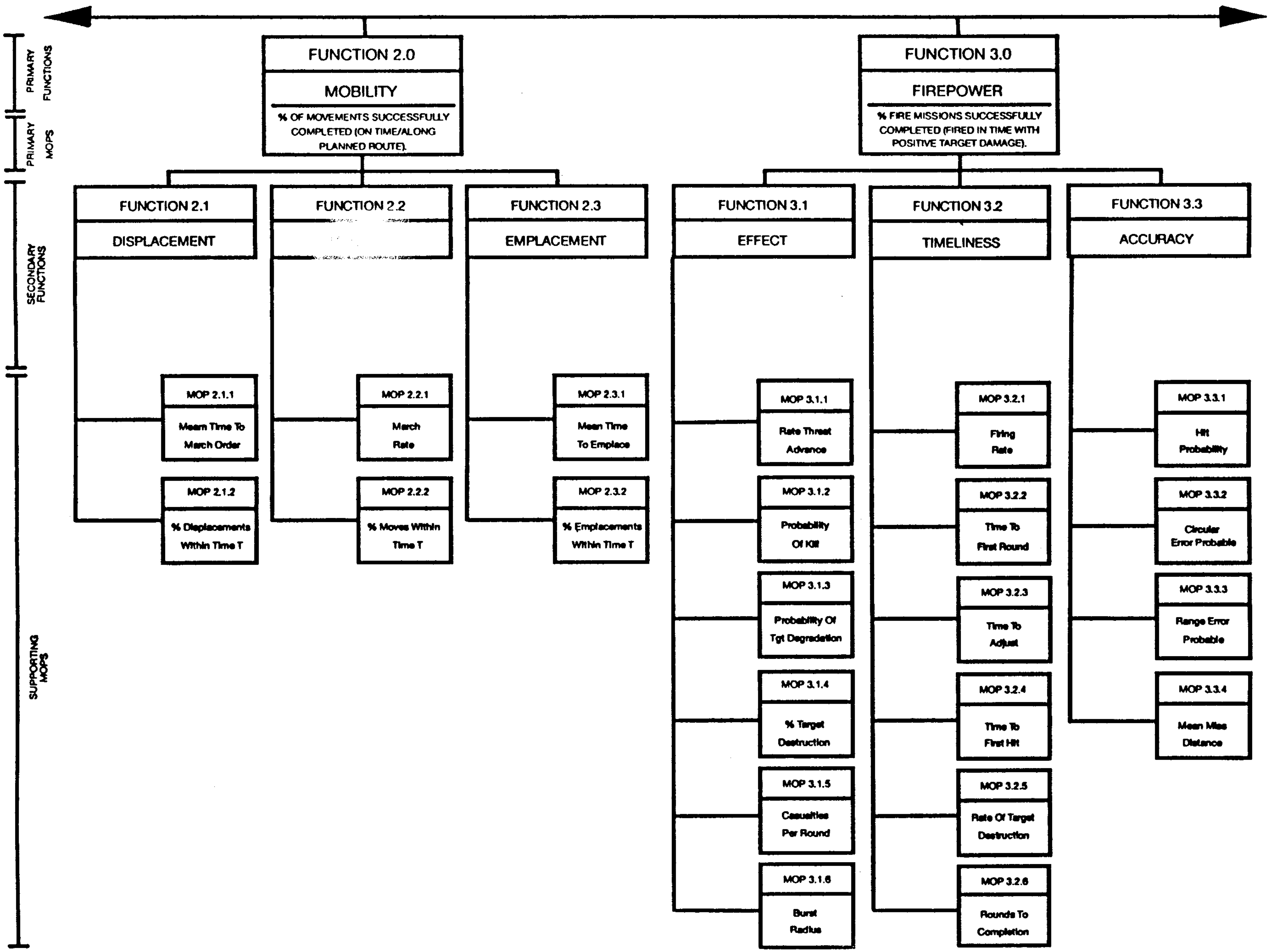


Figure 3-19 (cont). Example mission performance dendritic.

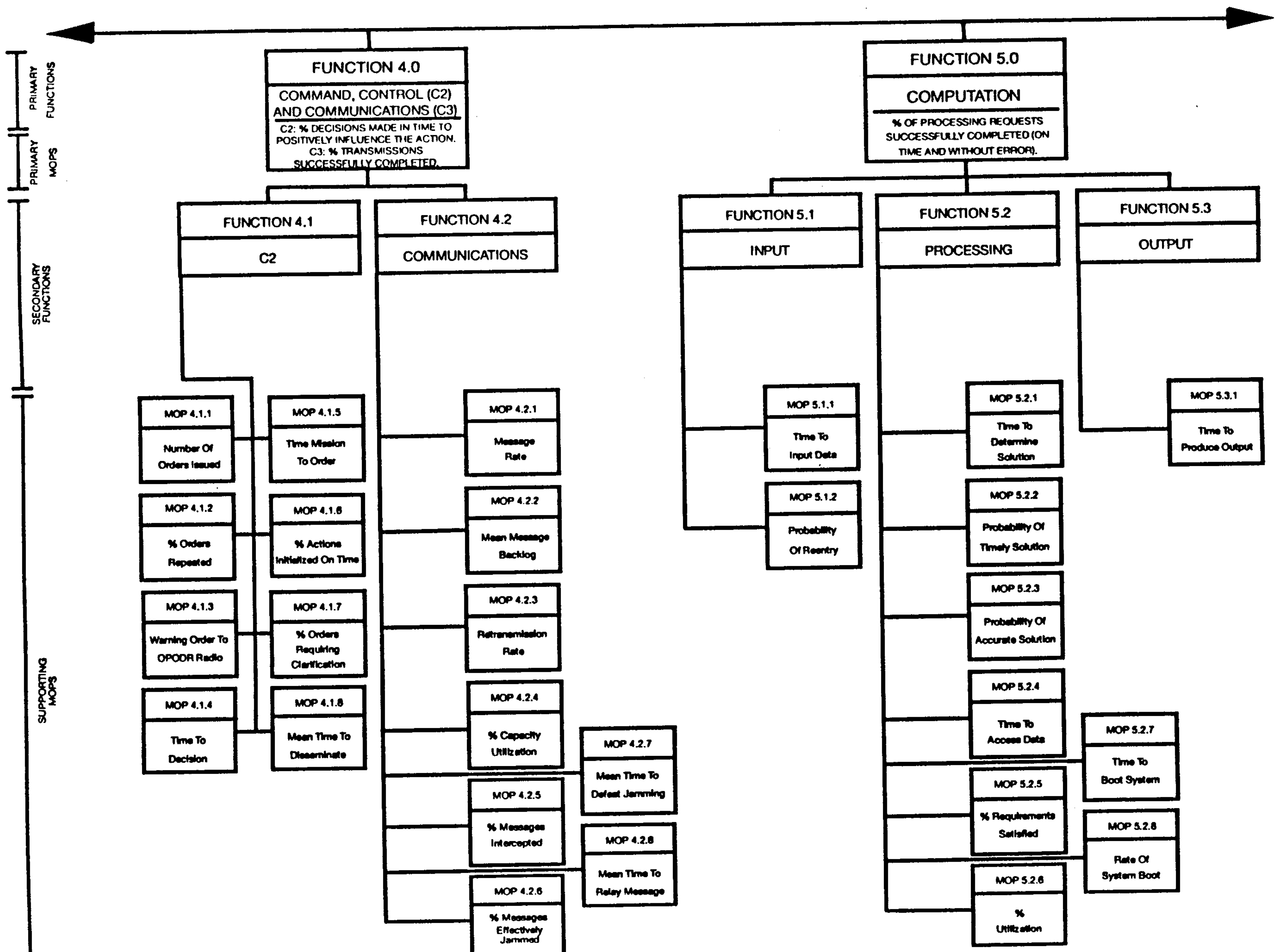
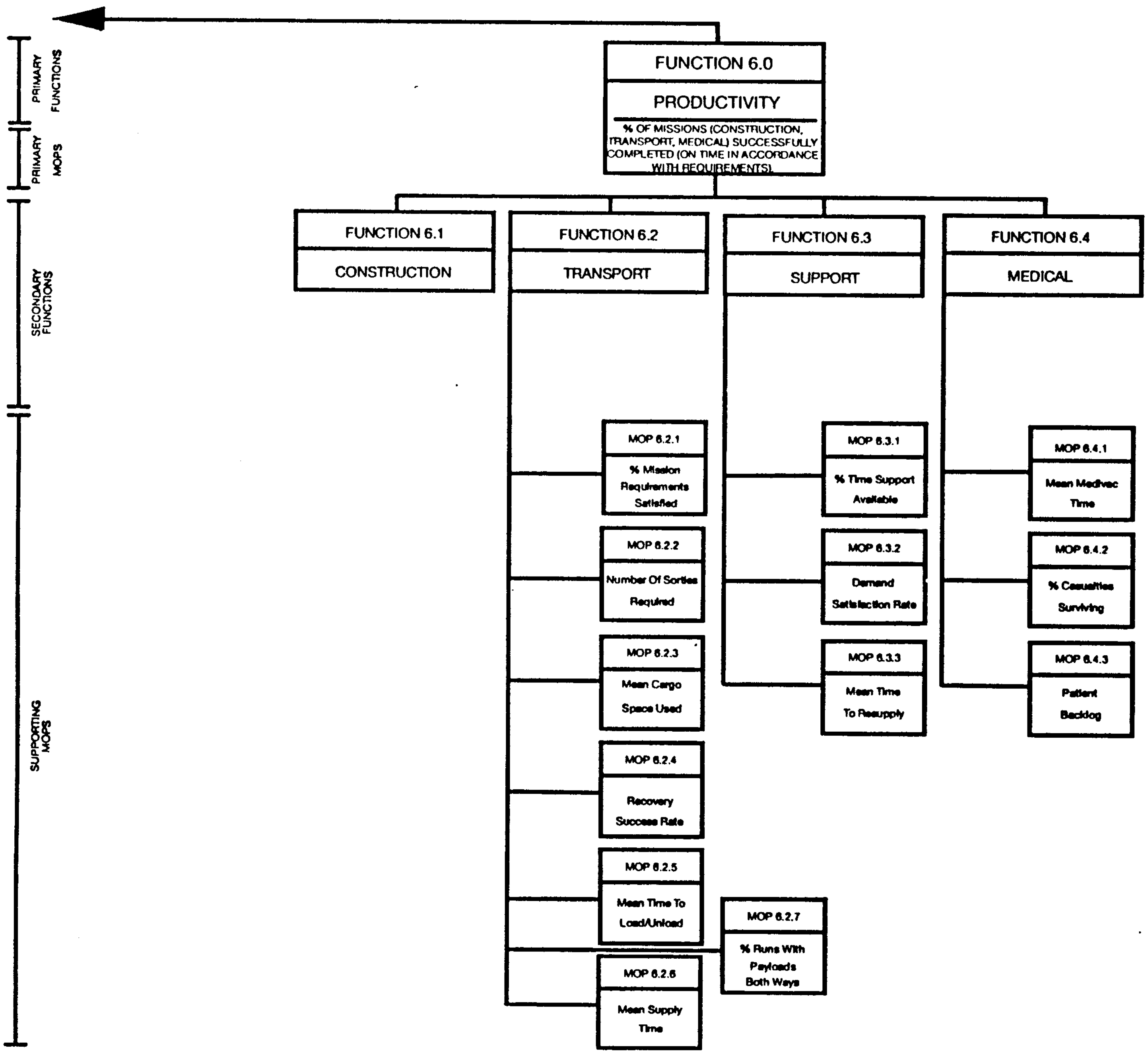


Figure 3-19 (cont). Example mission performance dendritic.



re 3-19 (cont). Example mission performance dendritic.

Issue	Criteria	MOE/MOP	IOT	FDTE	TT	ContrT	Model	Sim	MktSvy
1	1-1	1-1-1			P		S		
		1-1-2							P
		1-1-3	P			S			
	1-2	1-2-1		P					
		1-2-2			P				
	1-3	1-3-1						P	S
		1-3-2			P				
		1-3-3	P						
		1-3-4						P	
2	2-1	2-1-1							
		2-1-2				P			S
	2-2	2-2-1							
	2-3	2-3-1							
		2-3-2					P		
		2-3-3							
	2-4	2-4-1							
		2-4-2		P					

Figure 3-20. Data source matrix

LEVEL	DESCRIPTION	POSSIBLE FORMS	EXAMPLES OF CONTENT	DISPOSITION
Level 1 data "raw data"	Data in their original form. Results of field trials just as recorded.	Complete data collection sheets, exposed camera film, voice recording tapes, original instrumentation magnetic tape or printouts, original videotapes, filled questionnaires, interview notes.	1. All reported target presentations and detection. 2. Clock times of all events. 3. Azimuth and vertical angle from each flash base for each flash. 4. Recording tapes of interviews.	Accumulated during trials for processing. Usually discarded after use. Not ordinarily given to another agency. Not published.
Level 2 data "reduced data"	Data taken from the raw form and consolidated. Invalid or unnecessary data points deleted. Trials declared "no test" deleted.	Confirmed and corrected data collection sheets, film with extraneous footage deleted, corrected tapes of printouts, and original raw data with "no test" events marked out.	1. Record of all valid detections. 2. Start and stop times of all applicable events. 3. Computed impact points of each round flashed. 4. Confirmed interview records.	Produced during processing. Usually discarded after use. Not published.
Level 3 data "ordered data"	Data which have been checked for accuracy and arranged in convenient order for handling. Operations limited to counting and elementary arithmetic.	Spread sheets, tables, typed lists, ordered and labeled printouts, purified and ordered tape, edited film, edited magnetic tapes, ordered punch cards.	1. Counts of detections arranged in sets showing conditions under which detections occurred. 2. Elapsed times by type events. 3. Impact points of rounds by condition under which fired. 4. Interview comments categorized by type.	Not usually published but made available to analysts. Usually stored in institutional data banks. All or part may be published as supplements to test report.
Level 4 data "findings" or "summary statistics"	Data which have been summarized by elementary mathematical operations. Operations limited to descriptive summaries; no judgments or inferences. Does not go beyond what was observed in test.	Tables or graphs showing totals, means, medians, modes, maximums, minimums, quartiles, deciles, percentiles, curves, or standard deviations. Qualitative data in form of lists, histographs, counts by type, or summary statements.	1. Percentage of presentations detected. 2. Mean elapsed times. 3. Calculated probable errors about the centers of impact or conditions. 4. Bar graph showing relative frequency of each category of comment.	Published as the basic factual findings of test report.

Figure 3-21. Levels of data

LEVEL	DESCRIPTION	POSSIBLE FORMS	EXAMPLES OF CONTENT	DISPOSITION
Level 5 data "analysis" or "inferential statistics"	Data resulting from statistical tests of hypothesis or interval estimation. Execution of planned analysis data. Includes both comparisons and statistical significance level. Judgments limited to analysts selection of techniques and significant levels.	Results of primary statistical techniques such as T-tests, Chi-square, F-test, analysis of variance, regression analysis, contingency table analyses and other associated confidence levels. Follow-on tests of hypotheses arising from results of earlier analysis, or fallback to alternate nonparametric technique when distribution of data does not support assumption of normality. Qualitative data in the form of prevailing consensus.	1. Inferred probability of detection with its confidence interval. 2. Significance of difference between two mean elapsed times. 3. Significance of difference between observed probable error and criterion threshold. 4. Magnitude of difference between categories of comments.	Published in evaluation reports. (If evaluation report is part of test report, the level 5 analysis results are presented separately from the level 4 findings.)
Level 6 data "extended analysis" or operations	Data resulting from further analytic treatment going beyond primary statistical analysis, combination of analytic results from different sources, or exercise of simulation or models. Judgments limited to analysts' choices only.	Insertion of test data into a computational model or a combat simulation, aggregation of data from different sources observing required disciplines, curve fitting and other analytic generalization, or other operations research techniques such as application of queuing theory, inventory theory, cost analysis, or decision analysis techniques.	1. Computation of probability of hit based on target detection data from test combined with separate data or probability of hit given a detection. 2. Exercise of attrition model using empirical test times distribution. 3. Determination of whether a trend can be identified from correlation of flash base accuracy data under stated conditions from different sources. 4. Delphi technique treatment of consensus of interview comments.	Published as appropriate in evaluation reports.
Level 7 data "conclusions" or evaluation	Data conclusions resulting from applying evaluative military judgments to analytic results.	Stated conclusions as to issues, position statements, challenges to validity or analysis.	1. Conclusion as to whether probability of detection is adequate. 2. Conclusion as to timeliness of system performance. 3. Conclusion as to military value of flash base accuracy. 4. Conclusion as to main problems identified by interviewees.	Published as the basic evaluative conclusions of evaluation reports.

Figure 3-21. Levels of data (cont)

A. TRIAL HEADER RECORD

- WHEN, WHAT, WHO, HOW INSTRUMENTED

B. INTERVISIBILITY SEGMENT RECORDS

- WHEN DID PAIRS OF PLAYERS HAVE "INTERVISIBILITY"
- COULD EITHER PLAYER BE REASONABLY EXPECTED TO ENGAGE THE OTHER
- DID THE TEST SYSTEM DETECT, DISPLAY, IFF

C. TIME LINE RECORDS

- WHEN AND WHERE DID EVENTS IN ENGAGEMENT SEQUENCES OCCUR

D. FIRING RECORDS

- WHEN DID WEAPON FIRINGS OCCUR
- UNDER WHAT CONDITIONS
- WHAT Pk's ASSOCIATED WITH FIRING CONDITIONS
- WHAT WAS SIMULATED RESULT

E. MILES DEATH RECORDS

- WHICH PLAYERS PURPORTEDLY KILLED IN MILES ENGAGEMENTS

F. SYSTEM SEARCH FILE LOADING RECORDS

- ALL SORTS OF DETAILED SYSTEM DATA

Figure 3-22. Typical data base structure.

GENERAL RECORD TYPES

A. TRIAL HEADER (TH).
   1. One per trial.
   2. Specifies trial conditions.
   3. Specifies composition of red and blue forces during trial.

B. INTERVISIBILITY SEGMENT (IS) (POTENTIAL ENGAGEMENT OPPORTUNITY).
   1. One record for each time period during a trial when actions could potentially occur.
   2. Identifies general parameters applicable to this IS record (parameters vary depending on pair).
   3. Identifies for each player:
      a. Whether an engagement opportunity occurred.
      b. How many engagements occurred, if any.

C. SYSTEM TIME LINE (STL).
   1. Zero, one, or more than one record associated with each specific IS record.
   2. Applicable only to partial or completed engagements.
   3. Categorizes each STL as a 'reduction time' or a 'servicing time.'
   4. Specifies time, ranges, and other applicable parameters for each time line component.
   5. Identifies the number of bursts corresponding to the firing period (if any).

D. FIRING REPORT (FR).
   1. Record association varies depending on players involved and which player fires.
      a. Zero, one, or multiple records associated with STL (if any).
      b. Zero, one, or multiple records associated with IS (if no STL).
      c. Firings which do not result in pairings are included.
   2. Identifies shooter, target weapon, time, and all available relevant firing parameters for each shot fired or missile launched (includes gaggle ID as appropriate).

E. AUXILIARY FIRING REPORT (AFR).
   1. Reports firings indicated by MILES or video tape analysis, one record per firing.
   2. Identifies shooter ID or weapon type and target ID as well as approximate time of death.
   3. Gives results of firing (kill, near-mess, unknown).

F. SYSTEM SEARCH FILE LOADING (SFL).
   1. Multiple records for each Fire Unit every 1.6 seconds during trial.
   2. Gives record of search file loading by search file number, including object classification code, actual target ID (if correlated), priority points, and system actions against that search file during previous 1.6 seconds.

G. Pk TABLE (PKT)--PROVIDES RTCA Pk TABLES, OR MODIFICATIONS, IN MACHINE READABLE FORMAT.

Figure 3-23. Outline of data base required for analysis.

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN

CHAPTER 2. EVALUATION PLAN (when this chapter is prepared by the tester, it is called the ANALYSIS PLAN). This chapter is prepared by either the evaluator or the tester depending on the type of test or evaluation. When the evaluator prepares the chapter, it is called the Evaluation Plan. When the tester prepares the chapter, it is called the Analysis Plan. Paragraph side headings will use the evaluation terminology if prepared by the evaluator and analysis terminology if prepared by the tester. When the tester prepares an analysis plan in this chapter, the effort is simplified and abbreviated.

2.1. EVALUATION APPROACH (tester uses ANALYTIC APPROACH).

2.1.1. OVERVIEW OF THE EVALUATION/ANALYTIC APPROACH. This paragraph summarizes the overall approach to the evaluation of the system.

2.1.2. AGGREGATION OF OPERATIONAL EFFECTIVENESS. This paragraph shows the methodology by which the answers to the issue questions will be further analyzed and consolidated to permit conclusions or predictions/assessments to be drawn on the overall operational effectiveness of the system.

2.1.3. AGGREGATION OF OPERATIONAL SUITABILITY. This paragraph shows the methodology by which the answers to the issue questions will be further analyzed and consolidated to permit conclusions or predictions/assessments to be drawn on the overall operational suitability of the system.

2.2. OPERATIONAL ISSUES. This paragraph lists in turn each of the operational issues and associated criteria stated in TEP paragraph 1.7.

2.2.1. ISSUE 1. This paragraph contains the issue statement taken in turn from the issue statements in paragraph 1.7. The issues are stated in the form of a question for which a response will make a significant contribution to the decision making process. Scope and rationale need not be restated here as they are already provided in paragraph 1.7 and restatement would be unnecessary duplication.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.2.1.1. CRITERION 1-1. This paragraph contains the criterion statement taken in turn from the criteria statements for the issues in paragraph 1.7. The evaluator may add additional evaluator criteria to a critical issue. Criteria which are a part of the original COIC set will always have both a measure (parameter) and a threshold (value). Criteria developed by the evaluator may have only a measure. In those cases where the evaluator criterion lacks a threshold (value), the criterion will be labeled "investigative" and only the measure (parameter) specified.

2.2.1.1.1. MEASURE OF EFFECTIVENESS (MOE)/MEASURES OF PERFORMANCE (MOP) 1-1-1. Derive and state all MOE/MOP associated with the criterion. Each criterion must have one or more MOE or MOP. When the tester prepares chapter 2, there will normally be only MOP. The evaluator may find it necessary to use both MOE and MOP. This paragraph must define the individual MOE/MOP.

a. ANALYTIC DESIGN. The analytic design is a description of the logical process to be used to measure the MOE or MOP. The MOE and MOP may be grouped by like analytic designs.

b. ANALYTIC PROCEDURES. Analytic procedures are a description of the anticipated framework within which the data will be analyzed. This section serves as a "road map" for the analyses which are intended to identify or support evaluative conclusions. Parametric and nonparametric techniques should be specified, assumptions should be discussed, and statistical software packages should be specified. Group the MOE and MOP by like analysis concepts.

c. DATA PRESENTATIONS. The analyst proposes the data displays, tables, figures, or other forms of presentation appropriate for displaying data in reports. Tables must be provided for cell counts, percentages, measures of central tendency and variability, and for ANOVA tables. Group MOE/MOP by like presentations.

2.2.1.1.2. MOE/MOP 1-1-2.

through

2.2.1.1.x. MOE/MOP 1-1-x.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.2.1.1.x+1. CRITERION ANALYTIC SUMMARY. This summary describes the logical process which the analyst intends to use to resolve the criterion. Group the MOE and MOP by like analytic designs and concepts and describe how the data from the MOE and MOP sources will be integrated.

2.2.1.2. CRITERION 1-2.

through

2.2.1.y. CRITERION 1-y.

2.2.1.y+1. ISSUE ANALYTIC SUMMARY. This summary describes the logical process which the analyst intends to use to resolve the issue. Group analyses by like analytic designs and concepts and describe how the data from the criterion summaries will be integrated. The plan must call for a direct answer to the question asked in the issue statement for the final report.

2.2.2. ISSUE 2.

through

2.2.n. ISSUE n.

(NOTE: THIS IS THE END TESTER ANALYSIS PLANS)

2.3. DATA SOURCE MATRIX (DSM). All sources of data to be used in an evaluation or assessment must be described in the TEP. Each MOE or MOP must be addressed by at least a primary data source. Any test, model/simulation, market survey/investigation, or study/analysis listed as a primary or secondary data source for any MOP must be described in paragraphs 2.4 or 2.5. The matrix cells are to be filled with "P" or "S" to indicate whether the data source will provide a "primary" or "secondary" contribution to the evaluation. Matrix cells are left blank for data sources which are neither primary or secondary. Each MOP must have at least one primary data source.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.4. USER TEST APPROACH FOR THE TEST NAME (E.G. IOT, FOT, EUT, FDT). Use this paragraph to describe a user test for which the evaluator has derived the test approach and concept and whose test design is described in chapter 3. Repeat this paragraph as necessary (paragraph 2.4, 2.5, etc.) for multiple tests.

2.4.1. TEST SCOPE. The scope identifies the types of test scenarios and test events that are required to address the operational test MOPs (OTMOPs).

2.4.2. FACTORS AND CONDITIONS. Factors are the test variables identified as likely to affect test event outcome. Conditions are the discrete values that factors assume or are expected to assume.

2.4.3. TEST DESIGN MATRIX(ES). Using test events and scenarios identified in the scope and stated factors and conditions, the evaluator develops matrix(es) needed for grouping combinations of test conditions into "trials," "missions," or "phases." Matrixes are formed by crossing factors and conditions with one another. Large matrixes should be reduced to several smaller ones. Normally the analytic designs described in paragraphs 2.1 and 2.2 will reflect these matrixes.

2.4.4. SAMPLE SIZES. Based on the test design matrix(es), the evaluator estimates the aggregate sample sizes likely to occur under each combination of factors and conditions for tests of various lengths and for alternative formulations of test elements. Once sample sizes are determined, they are tabulated as matrixes showing numbers of valid test events to be conducted under various combinations of test conditions.

2.4.5. REQUIREMENTS FOR A DATA AUTHENTICATION GROUP (DAG). The evaluator identifies whether or not there are requirements for a DAG. This paragraph outlines the role of the DAG in data validation and in engineering analysis of test data.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.5. OTHER SOURCES OF DATA. All sources of data to be used in an evaluation or assessment must be described in the TEP. Any test, model, simulation, market survey, market investigation, study, or analysis listed as a primary or secondary data source for any MOE/MOP must be described in this paragraph. Each separate test and other effort comprising a discrete data source will have its own subparagraph in paragraph 2.5 and the paragraph numbering will be adjusted accordingly (e.g., 2.5.1. FDTE, 2.5.2. TT1, 2.5.3. TT2, 2.5.4. Contractor Test, 2.5.5. COEA Model, 2.5.6. Other Model, 2.5.7. Simulation, 2.5.8. Market Survey). This paragraph is omitted when the tester prepares chapter 2 of the TEP.

2.5.1. USER TEST NAME (e.g., FDT, FDE, CEP, CT). Use this paragraph to describe a user test which will be used in the evaluation and for which the evaluator has not derived the test approach and concept and whose test design is described in other documents. Repeat this paragraph as necessary for multiple tests. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated test. It provides the basis for understanding the value and context of the data derived from this source.

2.5.1.1. TEST SCOPE. Derive the scope from the plan of the test in sufficient detail to provide understanding of the test, the MOP to be addressed, test events, and type of data collected.

2.5.1.2. FACTORS AND CONDITIONS. Factors and conditions from the test plan are described in sufficient detail to provide a context for the data to be use

2.5.2. DEVELOPMENT TEST NAME g., DT, Contractor Test, etc.). Use this paragraph to describe a DT, a contractor test, or any other test, demonstration, or review. The test design will be described in the test plan for the test. Repeat this paragraph as necessary for multiple tests. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated test. It provides the basis for understanding the value and context of the data derived from this source.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.5.2.1. TEST SCOPE. Derive the scope from the plan of the test in sufficient detail to provide understanding of the test, the MOP to be addressed, test events, and type of data collected.

2.5.2.2. FACTORS AND CONDITIONS. Factors and conditions from the test plan are described in sufficient detail to provide a context for the data to be used.

2.5.3. MODEL OR SIMULATION NAME. Use this paragraph to describe a model or simulation which will provide data for the evaluation. Repeat this paragraph as necessary for multiple models and simulations. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated model or simulation. It provides the basis for understanding the value and context of the data derived from this source. Validation, verification, and accreditation sources and dates for the model or simulation must be listed in this paragraph.

2.5.4. MARKET SURVEY OR INVESTIGATION NAME. Use this paragraph to describe a market survey or investigation which will provide data for the evaluation. Describe the details of this survey or investigation from the written plan for the effort. Repeat this paragraph as necessary for multiple surveys and investigations. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated survey or investigation. It provides the basis for understanding the value and context of the data derived from this source.

2.5.5. OTHER STUDY OR ANALYSIS. Use this paragraph to describe a study or other analytic effort to be used to derive data for the evaluation. Describe the details of this study or analysis the written plan and/or report for the effort. Repeat this paragraph as necessary for multiple studies and analyses. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated study or analysis. It provides the basis for understanding the value and context of the data derived from this source.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 2--EVALUATION PLAN (cont)

2.6. DATA BASE STRUCTURE. The evaluator describes a data base file structure that will enable him to analyze test data in a thorough and timely manner and to integrate it with data from other sources.

2.6.1. IDENTIFICATION OF REQUIRED FILES. The evaluator specifies the files required and labels each with a short description of the type of data to be stored in each file. He also indicates for each file whether it is to be automated.

2.6.2. DESCRIPTION OF FILE RELATIONSHIPS. Describe the architecture used to organize the data base. The architecture typically consists of either a network or relational design for data storage.

2.6.3. DATA ELEMENT DEFINITIONS. For each file, the evaluator lists known data elements and provides sufficient definitions to preclude ambiguity and misunderstanding.

2.7. EVALUATION LIMITATIONS. This paragraph states known limitations of the evaluation and those data sources (to include the operational test) which support the evaluation. These limitations are to be presented and discussed in terms of the impact of the limitations. This will include an explanation of why the limitations exist, which COIC are impacted, and what can be done to minimize their impact.

Figure 3-24. Detailed guidance for the development and Documentation of Test and Evaluation Plans, Chapter 2 (cont)

Issue 1. How well do the proposed scout platoons perform compared to the standard scout platoons?		
Question 1.1	Question 1.2	Question 1.3
How effective are the two platoons in reconnaissance operations?	How effective are the two platoons in security operations?	How effective are the two platoons in economy-of-force operations?

Figure 3-25. Example of a subdivision of a test issue by situations

4.2 What are the logistics implications of weapons system A?		
4.2.1	4.2.2	4.2.3
What are the supply requirements of weapons system A?	What are the maintenance requirements of weapons system A?	What are the transportation requirements of weapons system A?

Figure 3-26. Example of a division of a subquestion by component attributes

3.7.5 Is weapon system A maintainable?		
3.7.5.1	3.7.5.2	3.7.5.3
What was the aver. no. of rounds fired between failures?	What was the aver. working time req'd to repair failures?	What was the ratio of maintenance hrs to rounds fired?

Figure 3-27. Example of division of a subquestion into measures

3.7.5.1 What was the average number of rounds fired between failures?

3.7.5.1.1 How many rounds were fired during each firing attempt before a failure occurred?

DE 3.7.5.1.1.1 Did the weapon successfully fire?

Figure 3-28. Example of subdivision to DE level, example 1

3.7.5.2 What was the average working time required to repair failures?

3.7.5.2.1 What was the working time required to repair each failure?

DE 3.7.5.2.1.1 What time did the armorer begin each work period?

DE 3.7.5.2.1.2 What time did the armorer end each work period?

DE 3.7.5.2.1.3 What was the numerical designation of the failure worked on during this period?

Figure 3-29. Example of subdivision to DE level, example 2

3.7.5.3 What was the ratio of maintenance hours to rounds fired?

3.7.5.3.1 What was the total number of hours devoted to maintenance?

DE 3.7.5.3.1.1 What time did the gunner or armorer begin each maintenance period?

DE 3.7.5.3.1.2 What time did the gunner or armorer end each maintenance period?

3.7.5.3.2 What was the total number of rounds fired?

DE 3.7.5.3.2.1 Did the weapon fire successfully each time?

Figure 3-30. Example of subdivision to DE level, example 3

1.3.7.4 Were organization communications personnel able to erect the antenna without difficulty?

1.3.7.4.1[a] What was the average time required to erect the antenna?

1.3.7.4.2[a] What percentage of the test personnel responded that erecting the antenna was "difficult"?

1.3.7.4.3[b] What were the comments of test personnel on the difficulty involved in erecting the antenna?

[a]MOP.
[b]Non-MOP.

Figure 3-31. Example of subquestion not leading to MOP

```
Issue 3  What.......?

         Question 3.1  What.......?

         3.1.1  ....?

         3.1.1.1  ....?

         DE 3.1.1.1.1  ....?

         DE 3.1.1.1.2  ....?

         3.1.1.2  ....?

         DE 3.1.1.2.1  ....?

         DE 3.1.1.2.2  ....?

         3.1.2  ....?

         3.1.2.1  ....?

         3.1.2.1.1  ....?

         3.1.2.1.1.1  ....?

         3.1.2.1.1.1.1  ....?

         DE 3.1.2.1.1.1.1.1  ....?

         DE 3.1.2.1.1.1.1.2  ....?
```

Figure 3-32. Example of PA format in text

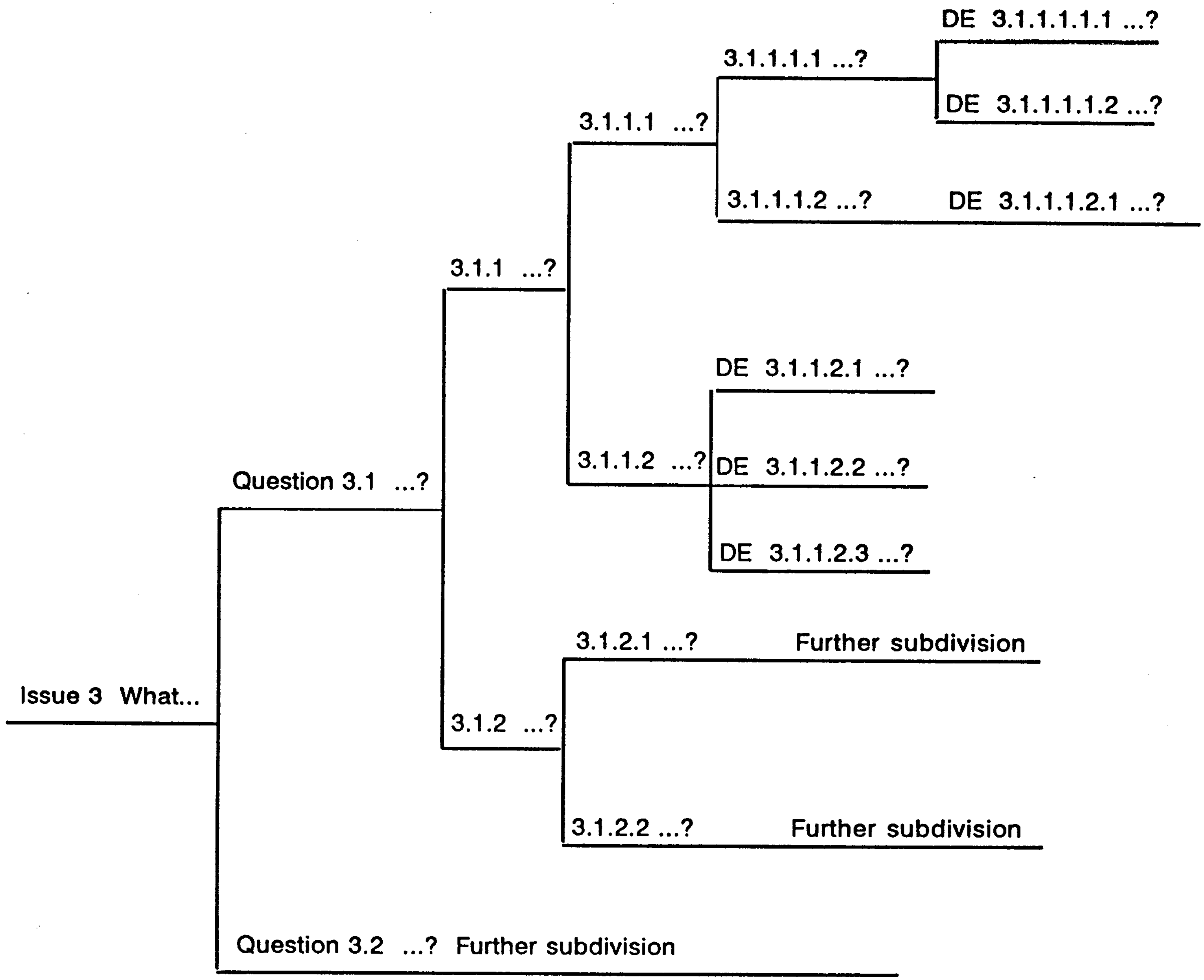


Figure 3-33. Example of dendritic tree format for a PA.

OPERATIONAL TEST

Purpose: To provide data on the operational effectiveness of weapon system A. Results will be used as input to the in-process review as a basis for a decision on continued development.

FORCE DEVELOPMENT TEST (CONCEPT)

Purpose: To evaluate the effectiveness of the airborne rifle company organized under proposed TOE 7-947T. Test results will be used by TRADOC as a basis for possible TOE changes.

FORCE DEVELOPMENT TEST (MATERIEL)

Purpose: To evaluate the military potential of the helicopter storage system. Results will be used by AMC to assess the utility of enclosed storage systems for helicopters and, if appropriate, as input for a required operational capability (ROC) document.

CONCEPT EVALUATION PROGRAM

Purpose: To evaluate the compatibility for the Generic Aviation Nitrogen Generator (GANG) with the AH-1, AH-64, CH-47, and UH-60 aircraft and nitrogen bottles. The results will be used to determine user acceptance and to identify future test requirements.

CUSTOMER TEST

To provide trajectory data on parachute loads requiring four G-11B parachutes equipped with two 2-second reefing line cutters and 100-foot center lines. Data will be provided to U.S. Army Natick Research, Development, and Engineering Center (NRDEC) to assist in determining if airdrop configuration changes are feasible.

Figure 3-34. Examples of purpose statements

TABLE 3-1. CLASSIFICATION OF TEST VARIABLES		
Independent	Dependent	Extraneous
Range of engagement	Percentage of hits	MOS of gunners
Target behavior	Miss distance	Level of training
Light conditions	Number of weapon failures	Weather
Type weapon		Wind
Weapon stabilization	User acceptance	Indiv marksmanship capability
		Leadership

Figure 3-35. Example of classification of test variables

TABLE 3-2. TREATMENT OF INDEPENDENT VARIABLES

Independent variables	Treatments
Range of engagement	200, 600, 1,000 meters
Target behavior	Moving, stationary
Light conditions	Day, night
Type weapon	Type A, type B
Weapon stabilization	Bipod, tripod

Figure 3-36. Example of treatment of independent variables

Factors	Control	Conditions
Range of engagement	Systematically varied	100-500, 501-900, 901-1,300 meters
Light conditions	Systematically varied	Day, night
Target movement	Systematically varied	Moving, stationary
Threat arrays	Systematically varied	IAW threat support package
NBC	Systematically varied	No MOPP, MOPP 2, MOPP 4
Terrain (phase I)	Systematically varied	Flat, rolling
Terrain (phase II)	Tactically varied	Rugged, swamp
Enemy action	Systematically varied	Attack, defend
Battlefield obscuration	Systematically varied	No smoke, smoke
EW environment	Systematically varied	IAW threat support package
Personnel	Held constant	5th-95th percentile
Organization	Held constant	Battery level
Doctrine/tactics	Held constant	IAW D&O support package or IAW TRADOC support package
Logistics support	Held constant	ORG, DS
Communications status	Tactically varied	Radio-voice, radio-digital
Enemy target	Tactically varied	Troops, vehicle bunker
Weather	Uncontrolled	Rain, dry, snow
System operating status	Uncontrolled	Fully operational, degraded mobility, degraded firepower, non-operational

Figure 3-37. Sample list of typical factors and conditions

Phase	Test phase matrix conditions	Events
1. Maneuver	Tactical, RTCA	Attack, defense meeting engagement
2. Live fire	Day, night	Moving, stationary targets
3. Transport-ability	Tactical, strategies	Aircraft, rail, wheel loading

Figure 3-38. Sample test phase matrix

Tank type	200 meter range Moving trial Rds	num	Still trial Rds	num	700 meter range Moving trial Rds	num	Still trial Rds	num
				Day				
M60	20	8	20	10	20	5	20	3
M1	20	4	20	13	20	16	20	15
				Night				
M60	15	1	15	11	15	12	15	7
M1	15	9	15	6	15	14	15	2

NOTE: Trial numbers indicate the randomized order in which trials will be performed so that the order of events will be mixed for different crews.

Figure 3-39. Sample of event matrix

Event number	Date/time	Location	Description
38	250400	GM 901456	2d Platoon, 3/7 Inf departs assembly area on mission to recon area WHITE.
39	250615	GM 345564	2d Platoon, 3/7 Inf receives change in mission from Company CO by radio. New mission is to conduct recon of area BLUE.
40	250830	GM 347895	2d Platoon, 3/7 Inf, enters meeting engagement with 2d Co, 4th Fusilier Tank Bn at checkpoint 7.

Figure 3-40. Suggested test scenario format

45. Problem: Friendly unit plans to attack positions considered occupied in the scenario but not actually manned by OPFOR.

Possible solutions, in order of desirability:

(a) Move an OPFOR unit into the area.

(b) Pass intelligence of barrier to induce change of plan.

(c) Allow attack of unmanned position.

(d) Order friendly unit to change plan (last resort).

Figure 3-41. Example scenario revision guidelines

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN

CHAPTER 3. TEST DESIGN. This chapter is prepared by the tester except when the TEP is used to plan evaluation for a milestone that will not be preceded by a dedicated phase of user testing. In those cases, the evaluator will provide a brief statement to that effect and the remainder of chapter 3 is eliminated. Use appendixes only as necessary where the material for a specific paragraph is too voluminous to be included in this paragraph without a break in the logical flow of information. Whenever an appendix is used, provide summarized information within the basic paragraph.

3.1. TEST DESCRIPTION. Describe the test to be conducted to address the operational issues, OTMOP, and data requirements specified in paragraph 3.2.

3.1.1. TEST PURPOSE. This paragraph contains the purpose of the test and where the results will be used. This will be the same as the test purpose contained in the OTP.

3.1.2. TEST AUTHORITY. The authority to conduct the test will be outlined here and will consist of a reference to the DA memorandum approving the current FYTP and the number of the approved OTP.

3.1.3. TEST OVERVIEW. This portion should provide an overview of the test design. The purpose of the test design is to execute the concepts described by the IOE in chapter 2 of the TEP.

3.1.3.1. TEST PHASES. Based on the test approach in chapter 2 of the TEP, the tester describes the tactical context and the associated scenario, environment, threat, tactics, and doctrine to be used in each test phase.

3.1.3.2. FACTORS AND CONDITIONS. The factors and conditions defined in chapter 2 of the TEP are reviewed and refined. As necessary, the tester, in conjunction with the operational evaluator, refines the factors and conditions by adding factors. For a given factor, the tester refines the factors by changing the number of conditions, redefining the conditions or changing the type of control (systematically varied, tactically varied, uncontrolled, or held constant).

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

3.2. CONDUCT OF TEST. Describe the conduct of the test in terms of its tactical context, events, control, phasing, scheduling, and methodology.

3.2.1. TACTICAL CONTEXT. Based on the test concept in chapter 2 of the TEP, describe the tactical context and associated scenarios, environment, threat, tactics, and doctrine to be used in each test phase.

3.2.1.1. SCENARIO(S). The scenario description consists of the geographic portrayal of the area, forces, and events of a hypothetical armed conflict.

3.2.1.2. TEST ENVIRONMENT. The use of test site terrain is described for each phase, scenario, mission, or trial.

3.2.1.3. THREAT FOR TEST. Describe how the threat systems and tactics will be played in each phase. An approved threat will be used in accordance with AR 381-11. The threat will be described in sufficient detail to permit realistic testing.

3.2.1.4. TACTICS AND DOCTRINE. This paragraph describes the friendly tactics and doctrine to be played in each phase. The phases are designed within the tactical and doctrinal framework of the D&OTSP.

3.2.1.5. TEST UNIT ORGANIZATION. Data on test player forces that will operate the system and portray the supporting, supported, and adjacent forces in play. Identify type of test unit or organization for the test. Discuss how the unit is organized any significant requirements of the unit. Include additional information such as TOE designation, as required.

3.2.2. TEST EVENTS. Include discussions of the organization and overall layout of the test to include sequence of phases. Flow diagrams, time lines, and matrixes are used as appropriate to introduce the events described.

3.2.2.1. MISSION AND VIGNETTE/BATTLE DESCRIPTION. A description of each distinct mission, vignette, or battle which is a part of the overall test.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

3.2.2.2. SITE SPECIFIC VIGNETTES/BATTLES. A list of mission, vignettes, or battles by test site, range, or route. This may be a figure or a table called out by this paragraph. Terrain maps may be used as figures in the test to depict the various vignettes/battles.

3.2.2.3. VIGNETTE/BATTLE LIST. An overall list of missions, vignettes, and battles. This may be a figure or a table which is called out by this paragraph.

3.2.2.4. EVENT MATRIX(ES). Matrices necessary to organize the test events. These matrixes may appear in the test as figures or tables called out in this paragraph.

3.2.2.5. EVENT SEQUENCING. A time-phased listing of events. This may be a figure or a table which is called out by this paragraph.

3.2.3. CONTROL PROCEDURES. Include descriptions of the control structure and procedures to be used to ensure that required test events occur in situations that realistically depict the tactical context of the test in accordance with the OMS/MP. The paragraph ties together control requirements for each OTMOP in paragraph 3.2. The control procedures are expanded into a Control Concept in Appendix J.

3.2.4. SCHEDULE OF EVENTS. Overall test schedule. This information may appear in a figure or table called out in this paragraph.

3.2.5. OVERALL METHODOLOGY. Include descriptions of execution procedures, control procedures, data collection procedures, and any other information necessary for an understanding of the matrix that is applicable to all issues.

3.2.6. TEST LIMITATIONS. All known limitations to the adequacy of the test (such as duration, number of systems, availability of interoperable systems, test unit availability, and ITTS and their impact on the OTMOPs will be described.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

3.3. TEST DETAILS. This paragraph is a thorough description of how the tester intends to provide the OTMOP. Arrangement should be such that major paragraphs are presented for each issue. This organization is, therefore, directly aligned with issues in TEP chapter 2. Each operational issue in paragraph 2.2 that contains one or more OTMOP is an issue to be addressed in OT. Issue numbers should carry forward, so that there may be gaps in the issue numbering which reflects paragraph 2.2 issues not addressed in the OT. For abbreviated evaluations and for testing of CBTDEV and TNGDEV products, all of the MOP developed in chapter 2 will be OTMOP.

3.3.1. ISSUE 1. This is a restatement of issue 1 as listed in chapter 2 of the TEP.

3.3.1.1. OTMOP 1-1. This is the first OTMOP associated with issue 1. The criteria associated with this issue are not listed. If the events, control mechanisms, collection methods, reduction methods, and analysis methods are closely aligned for all OTMOP associated with this test issue, paragraphs that follow only need to be stated once. If not aligned, the following paragraphs must be developed for each OTMOP.

a. METHODOLOGY. This paragraph describes the test events that must be executed to generate the data required, the operational conditions under which the events must occur, the techniques for collecting the data, and the control procedures that will be used to ensure that test events occur at the proper time and place and under the conditions specified. Where appropriate, reference can be made to information previously presented in paragraph 3.2.5 of the TEP.

(1) TEST EVENTS. Required events should be listed or referenced to the appropriate subparagraph of paragraph 3.2.2 of the TEP.

(2) CONTROL CONCEPTS. Describe the specific control procedures and rules of engagement that will be employed to ensure that required test events occur in situations that realistically depict the tactical context of the test. Specify the level of operational realism required in the test (full tactical simulation, limited tactical simulation, or no tactical simulation) and the rationale for the choice.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

b. DATA REQUIREMENTS. Data requirements applicable to each OTMOP should be extracted from Appendix G, Pattern of Analysis, and summarized here. This section should not be merely a repeat of the information in appendix G. If no new information is to be presented, reference can be made to the appropriate section of appendix G for data requirements. Information concerning data accuracies and sample sizes not presented in paragraph 3.1 or in chapter 2 of the TEP should also be presented here.

c. DATA COLLECTION. Describe the procedures for the collection and tabulation of test data and the specific organization and procedures to be used to collect the required data.

d. DATA REDUCTION. Describe the procedures for the processing of test data. Each method to be employed to process data required to answer the OTMOP should be addressed.

e. DATA ANALYSIS. Describe the logic for formulating and computing findings and formulating any assessments which might be required.

3.3.1.2. OTMOP 1-2.

through

3.3.1.x. OTMOP 1-x.

3.3.2. ISSUE 2.

through

3.3.n. ISSUE n.

3.4. TEST DATA MANAGEMENT. Provide the concepts for data management and the requirements for the tester data base.

3.4.1. DATA COLLECTION CONCEPT. Describe the test element organization and responsibilities for data collection and instrumentation operation and maintenance. Delineate the requirements for data collector training on the test item and use of data collection equipment.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

3.4.2. DATA REDUCTION CONCEPT. Describe the process in which recorded test data is organized, reduced, verified, managed, controlled, and stored. Organize the data in terms of the collection source (RAM collection form, cockpit digital recorder, radar tapes, etc.). Diagram the process through which each set of collected data is to pass before reaching the storage medium which supports the test directorate and the evaluator. This data flow diagram identifies where data is combined with other data, where it is processed, scored, reorganized, validated, or otherwise manipulated.

3.4.3. QUALITY CONTROL CONCEPT. Outline the process for independently validating test data. Define the checks and procedures which are to be used to preclude or detect and correct errors made in data collection, data entry, or data reduction. It also identifies emerging data summaries required to identify potential inconsistencies.

3.4.4. DATA REDUCTION TIMELINES. Provide a timeline flow of the various data collection processes.

3.4.5. DATA BASE DESIGN. When test data are extensive enough to require storage in an automated data base, the structure and content of the data base is described in this section.

3.4.5.1. DATA ELEMENT DICTIONARY. The data in each file or record are to be listed and augmented by any necessary definitions.

3.4.5.2. DATA BASE STRUCTURE. Provide data base structure diagrams which expand on data base descriptions in chapter 2.

3.4.5.3. DATA COLLECTION FORMS MATRIX. Provide a crosswalk of data elements and the data collection forms on which these data elements will be collected.

3.5. TEST PERSONNEL, EQUIPMENT, AND MATERIALS.

3.5.1. TEST DIRECTORATE ORGANIZATION. Describe the makeup and general organization of the test directorate required to execute the test as described in the test.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
CHAPTER 3--TEST DESIGN (cont)

3.5.2. TRAINING. This paragraph describes test training requirements. Training requirements (actual training and necessary resources) consist of two major elements: training the test players and training the test organization personnel.

3.5.2.1. TEST PLAYER PERSONNEL. A summary of training to be given to personnel or units in preparation for certification (OTRS) and testing should be presented.

3.5.2.2. TEST DIRECTORATE PERSONNEL. Training to be presented to controllers, data collectors and reducers, and other test personnel should also be summarized.

3.5.3. EQUIPMENT AND MATERIALS.

3.5.3.1. INSTRUMENTATION. Describe the instrumentation required to support the test.

3.5.3.2. TARGETS AND THREAT SIMULATORS. Describe the targets and threat simulators required to support the test.

3.5.3.3. ADP EQUIPMENT. Describe the ADP equipment and architecture required to support the test.

3.5.3.4. AUDIOVISUAL EQUIPMENT. Describe the audiovisual equipment required to support the test.

3.5.3.5. TEST SUPPORT EQUIPMENT. Describe the all equipment, materiel, and services required to support the test not otherwise enumerated above.

3.5.3.6. TEST SUPPORT FACILITIES. Describe the base and range facilities (B&RF) required to support the test.

3.6. ENVIRONMENTAL AND ENERGY IMPAC[illegible] Summarize the environmental and energy impacts fro[illegible] [illegible]pendixes P and Q.

Figure 3-42. Detailed guidance for the development and documentation of Test and Evaluation Plans, Chapter 3 (cont)

TEST CHANGE PROPOSAL FOR FULL-EVALUATE TEP

Date:

Tested System	Medium Tactical Wheel (MTW), IOTE 91-OT XXXX-0001
Proposed By	Major Hotspur J. Treadhead, CSTE-EXX, Operational Evaluation Command (Operational Evaluator)
Proposed Change	Terminate MTW night operations. Convert remaining night-test periods to day-time test periods. Total test length will remain unchanged.
Rationale	The change is desired in order to provide an opportunity to increase test mileage and facilitate meeting IOTE RAM mileage goals.
Resource Impacts	A: Time. Reduce night operations from the originally planned 27 days to 21 days of test time. B: Cost. Unknown at this time. C: Personnel. No impact.
Other Impacts	None.
Coord	Verbal coordination has been performed with headquarters, OEC; Office of the DUSA(OR); and Office of the DOTE. Have obtained concurrence.

APPROVAL:	TEXCOM	OEC
	IZZY. A. TESTER BG, USA Commanding	LORENZO P. OVERVUE Col, AG Commanding

RELEASED: United States Army
Operational Test and Evaluation Command

WILLIE J. TOPDOG
Major General, USA
Commanding

ATTACHMENTS: Revised page of TEP

Figure 3-43. TCP format for full-evaluate level TEP

TEST CHANGE PROPOSAL FOR OTHER THAN FULL-EVALUATE LEVEL TEP	
	Date:
Tested System	Medium Tactical Wheel (MTW), IOTE 91-OT-XXXX-0001
Proposed By	LTC Hotspur J. Treadhead, CSTE-EXX, Operational Evaluation Command (Operational Evaluator)
Proposed Change	Terminate MTW night operations. Convert remaining night-test periods to day-time test periods. Total test length will remain unchanged.
Rationale	The change is desired in order to provide an opportunity to increase test mileage and facilitate meeting IOTE RAM mileage goals.
Resource Impacts	A: Time. Reduce night operations from the originally planned 27 days to 21 days of test time. B: Cost. Unknown at this time. C: Personnel. No impact.
Other Impacts	None.
Coord	Verbal coordination has been performed with headquarters, OEC; Office of the DUSA(OR); and Office of the DOTE. Concurrence has been obtained.
APPROVAL:	
	IZZY A. TESTER BG, USA Commanding
ATTACHMENTS:	Revised page of TEP

Figure 3-44. TCP format for other than full-evaluate level TEP

COORDINATION:

Test and Experimentation Command

Opnl Tester   Concur/nonconcur (Test Officer/MAJ)
INIT:____DATE________
Opnl Analyst   Concur/nonconcur (Analyst/CPT)
INIT:____DATE________

Operational Evaluation Command

Opnl Evaluator Concur/nonconcur (Evaluator/LTC)
INIT:____DATE________
Eval Analyst   Concur/nonconcur (Analyst/GM14)
INIT:____DATE________

Figure 3-45. Tester/evaluator coordination block for TCP submission

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
APPENDIXES

APPENDIXES: Some appendixes are provided by the evaluator. Some appendixes are provided by the tester. Responsibility for each appendix is annotated below. Any appendix shown as optional is not required if the information can be adequately addressed in the body of the TEP. If an appendix is not used, show that by a place holder. Do not redesignate appendixes.

APPENDIX A - SUPPORTING DOCUMENTATION. This required appendix is developed by the evaluator and provides a listing of pertinent system documentation to include, as a minimum, the MNS, ORD, TEMP, OTP, TSP, and the TEA and EIS (if applicable). Each document is listed by title, responsible activity, status (e.g., approved, draft, under revision), and date of approval or draft.

APPENDIX B - BACKGROUND. This optional appendix is prepared by the evaluator and contains details of the background of the system and T&E of the system. If the details to be placed in TEP paragraph 1.3 are so voluminous that TEP continuity is lost, they are summarized in the TEP with details in appendix B. Appendix B is optional if details are adequately covered in the TEP.

APPENDIX C - SYSTEM DESCRIPTION. This optional appendix is prepared by the evaluator and includes a description of the system (or CBTDEV/TNGDEV product). If a large amount of detail is required to adequately understand the system, a lengthy system description is included as Appendix C. Appendix C is optional if the details are be adequately covered in the TEP.

APPENDIX D - PROJECTED THREAT. This optional appendix is prepared by the evaluator and defines the approved threat in the post-IOC timeframe of the tested system. If a large amount of detail is required to adequately understand the threat, a lengthy threat statement is included as Appendix D. Appendix D is optional if the details can be adequately covered in the TEP.

APPENDIX E - DAG CHARTER AND SOP. The evaluator includes a copy of the DAG Charter and SOP if a DAG requirement is specified in TEP chapter 2. For abbreviated evaluations or tests of CBTDEV or TNGDEV products, the tester may use a DAG and add this appendix.

Figure 3-46. Detailed guidance for the development and documentation of Test and Evaluation Plans, appendixes

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS APPENDIXES (continued)

APPENDIX F - OUTLINE TEST PLAN (OTP). A copy of the most recent and approved OTP referenced in Appendix A is included as Appendix F by the tester. Where appropriate, a test resume sheet (TRS) may be substituted for the OTP.

APPENDIX G - PATTERN OF ANALYSIS. The POA is the tester's detailed refinement of each operational test issue and associated criteria into OTMOPs and data elements. It should be developed as the first step in the preparation of the test design for all tests. The final POA is included here.

APPENDIX H - TEST SCENARIO(S). This optional appendix contains details of the test scenario not contained in the main body of the document.

APPENDIX I - TEST THREAT. This optional appendix contains threat portrayal details not contained in the main body of the TEP.

APPENDIX J - CONTROL CONCEPT. Include descriptions of the control structure and procedures that will be used to ensure that required test events occur in situations that realistically depict the tactical context of the test IAW the OMS/MP. The control concept is a preview of the Control Plan in the DTP.

APPENDIX K - DATA MANAGEMENT CONCEPT. Outlines test organization and responsibilities for data management. The data management concept is a preview of the Data Management Plan of the DTP. The following information is to be included.

APPENDIX L - INSTRUMENTATION, TARGETS, AND THREAT SIMULATORS (ITTS) SUPPORT CONCEPT. This optional appendix contains details of planned ITTS support not contained in the main body of the document. The ITTS support concept is a preview of the ITTS Support Plan in the DTP.

APPENDIX M - AUDIOVISUAL SUPPORT CONCEPT. This optional appendix contains details of planned audiovisual support not contained in the main body of the document. The audiovisual support concept is a preview of the Audiovisual Support Plan in the DTP.

Figure 3-46. Detailed guidance for the development and documentation of Test and Evaluation Plans, appendixes (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND
DOCUMENTATION OF TEST AND EVALUATION PLANS
APPENDIXES (continued)

APPENDIX N - ADP SUPPORT CONCEPT. This optional appendix contains details of planned ADP support not contained in the main body of the document. The ADP support concept is a preview of the ADP Support Plan in the DTP.

APPENDIX O - TRAINING CONCEPT. The training concept is actually developed during the evolution of the control concept and data management concept. This appendix contains details of planned training of both player personnel and test directorate personnel. The training concept is a preview of the Training Plan in the DTP.

APPENDIX P - TEST SUPPORT CONCEPT. This optional appendix contains details of planned test support (equipment, materiel, personnel, and services) not contained in the main body of the document. The test support concept is a preview of the Test Support Plan in the DTP.

APPENDIX Q - TEST ENVIRONMENTAL ASSESSMENT (TEA). The tester includes a copy of the approved TEA (if applicable).

APPENDIX R - ENVIRONMENTAL IMPACT STATEMENT (EIS). The tester includes a copy of the approved EIS (if applicable).

APPENDIX S - DOTE APPROVAL OF THE TEST CONCEPT. This appendix is required for TEP for all DOTE oversight programs. The evaluator includes a copy of formal DOTE approval of the test concept.

APPENDIX T - TEST CHANGE PROPOSALS (TCP). This required appendix is added as a placeholder by the tester. As TCP are developed during the time between TEP approval and end of the test, they are added in chronological sequence as tabs to the appendix.

APPENDIX U - GLOSSARY, ACRONYMS, AND ABBREVIATIONS. This appendix is prepared as required by the evaluator and the tester. Any unusual technical terms or frequently used acronyms and abbreviations in the body of the TEP or in other appendixes will be defined in this appendix by the evaluator for his portion of the TEP and by the tester for those terms which he has introduced and which were not previously defined by the evaluator.

Figure 3-46. Detailed guidance for the development and documentation of Test and Evaluation Plans, appendixes (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST AND EVALUATION PLANS APPENDIXES (continued)

APPENDIX V - TEP COORDINATION RECORD. A listing of agencies with which the TEP was coordinated and a record of comment resolution.

APPENDIX W - AUTHORS AND SUPPORTING PERSONNEL. For historical purposes, all individuals having input to or knowledge of the writing of the TEP should be listed in this appendix by the evaluator unless the listing of personnel on the coordination sheet is sufficient.

APPENDIX X - DISTRIBUTION. Distribution of the TEP by organization and number of copies is shown in this appendix by the evaluator.

Figure 3-46. Detailed guidance for the development and documentation of Test and Evaluation Plans, appendixes (cont)

Chapter 4
Management of Test and Evaluation Resources

4-1. Resources for operational testing
This chapter provides specific information for the management of resources to support operational, customer, and other user tests with emphasis on Operational Test and Evaluation (OT&E). It includes details on the processes, products, and responsibilities of Army organizations in the management of test and evaluation resources. Resources are defined here as the personnel, funding, materiel, and documentation required for effective test and evaluation.

4-2. OT&E management processes
Operational testing (OT) requirements originate from OSD's Joint Testing Program, Multiservice and Army Test and Evaluation Master Plans (TEMP), Army's Concept Evaluation Program (CEP), and materiel and combat developers with special needs (customer tests). The processes that support OT planning, documentation, and execution include OSD's JT&E and Feasibility Study processes, Test Integration Working Groups (TIWG), Test Schedule and Review Committee (TSARC) (see figure 4-3), Five Year Test Program (FYTP), TRADOC's CEP Schedule and Review Committee (CEPSARC), OPTEC Operational Test Readiness Reviews (OTRR), and OPTEC Test and Evaluation Coordination Offices (TECO) and test directorates located at TRADOC installations. An explanation of how these processes work and relate to each other follows.

4-3. Joint/Multi-Service Test and Evaluation (JT&E)

a. OSD Directed JT&E. This type of T&E brings two or more services together to evaluate developmental or operational concepts, inter-operability, methodologies, models and simulations, test beds, etc., as directed in a formal charter from the Deputy Director, Defense Research and Engineering (Test and Evaluation) (DDDRE(T&E)). The JT&E program is supported by an annual OSD nomination process, a feasibility study process of 7-8 months, and a testing process of 3 or more years.

(1) Army nominations to conduct a JT&E may be drafted at anytime by any organization. The Army's JT&E solicitation and nomination process is controlled and implemented by DA ODCSOPS (DAMO-FDT). The selection of suitable nominations to become feasibility studies and the selection of completed feasibility studies to become chartered OSD directed JT&E is determined primarily by the recommendations of the Senior Advisory Council (SAC), co-chaired by the DDDRE T&E, and the Director, Operational

Test and Evaluation (DOT&E). The SAC, which includes Army representation form DA ODCSOPS, reviews the nominations and recommends selected nominations for entry into the feasibility study phase.

(2) During the next 6-9 months, the feasibility study director supported by TDY AD Hoc personnel identify the proposed JT&E details: issues, objectives, milestones, developmental/ operational requirements, resources, funding, possible test locations, preliminary test design, and requirements for simulations, instrumentation, joint exercises, data collection, and evaluation. Upon completion of the feasibility study and favorable review by the SAC, the JT&E candidate may be recommended for charter as a JT&E.

(3) JT&E charters provide for a "lead service" and one or more "supporting services." The services provide necessary O&M funding, PCS personnel, and other TDY personnel and equipment support for the JT&E consistent with their involvement as defined in the approved feasibility study.

(4) OPTEC has overall Army management responsibility for JT&E. Accordingly, OPTEC provides a member to the Joint Test Planning Committee. This is a working level body which meets to review nominations/feasibility studies, provide advice on JT&E, exchange service positions and prepare nominations and recommendations for presentation to the SAC. As the resource manager in support of chartered JT&E, OPTEC maintains manpower authorizations on the U.S. Army Element Joint Test Activities TDA, requisitions personnel to staff the full time test directorate positions, budgets for the Army's participation and lead service costs, and coordinates Army-wide JT&E support requirements through the TSARC process. (See figure 4-3.) Although OPTEC is not responsible for the detailed management of the joint test force (JTF), OPTEC provides technical T&E advice through test document reviews, technical advisory groups (TAGs), General Officer Steering Committees (GOSC), and membership on the OSD Technical Advisory Board (TAB).

b. Multiservice Test and Evaluation (MT&E). Multiservice tests are normally initiated by a Joint Service Operational Requirement (JSOR). Tests are conducted for systems being acquired by more than one DOD or for systems which interface with equipment of another service. OSD will designate a lead service which will prepare the final report on the system. However, resource planning and support is the same as for any other Army OT. Requirements are documented, coordinated, and prioritized in the TSARC and FYTP processes. As with JT&E, OPTEC is the focal

point for coordination of Army resources to support multiservice test and evaluation. This includes budgeting for the testing necessary to accomplish assigned test objectives and for participation of our personnel and equipment in the entire test program.

4-4. Test and Evaluation Master Plan (TEMP), reference: Part Two, TEMP Format, Review and Approval Procedures
Program managers (PM) are responsible for developing the TEMP, which is a basic planning document for all life cycle test and evaluation activities.

a. Key elements of the TEMP for resource planning are contained in Parts IV (Operational Test and Evaluation Outline) and Part V (Test and Evaluation Resource Summary). The operational tester and evaluator participate in TEMP development as members of the Test Integration Work Group (TIWG), a PM chaired forum promulgated to develop the TEMP as well as work issues throughout the T&E process.

b. The TEMP sets in motion all T&E activities. An Army approved TEMP is required before resources can be documented, approved and tasked for in the Army's Five Year Test Program (FYTP). The FYTP seeks to identify all resources required NLT two years out from T-date (the date record testing begins). This is a must to align the user unit training and readiness objectives with those of OT in a mutually supporting manner without degrading the readiness of units tasked to support OT.

c. Every effort must be made to identify long lead resource requirements such as, instrumentation, targets, modeling and simulation, and other budgeted items. Accordingly, these will be reflected in command budgets and outline test plans (OTPs) so they can be developed and available in a timely manner.

d. TEMPs should not identify a specific test unit or location unless only one option is feasible. The Army's Test Schedule and Review Committee (TSARC) takes all requirements into account when developing who will support and where OT will be accomplished in order to promote equity among support providers, and support other OT principles.

e. TEMPS must identify all OT to be accomplished before support can be approved. This includes Developmental Tests (DT) requiring user support, Early User Tests and Experimentation (EUT&E), Force Development Test and Experimentation (FDT&E), Limited User Tests (LUT), Initial Operational Test and Evaluation (IOT&E), and Follow-on Test and Evaluation (FOT&E). All these

categories of tests must be planned and coordinated in the Army's TSARC (see figure 4-3) and FYTP processes.

4-5. TSARC/FYTP Processes

a. The TSARC is a General Officer Committee, chaired by Commander, OPTEC, that meets semiannually to provide recommended priorities and resource support responsibilities for user supported tests to the DA DCSOPS for approval and implementation. The end products of the TSARC are the FYTP, and test priority lists for the current and budget year.

b. Resource support responsibilities are provided in detail in outline test plans (OTP) submitted to the TSARC by operational and developmental testers. (See figure 4-1, OTP Format.)

(1) All direct costs for operational testing are delineated in an OTP. It lists the necessary resources and the administrative requirements to support an operational test and evaluation, as well as associated suspense dates and test milestones.

(2) When included in the approved FYTP, an OTP (see figure 4-1) becomes a formal resource tasking document for test execution and resource allocation within program and budget constraints.

(3) OTPs are prepared by the operational tester as designated by HQDA DCSOPS (or materiel developer for TT when non-organic or user troops are required) and maintained by Headquarters, OPTEC for the TSARC process. OPTEC is the operational tester for most Army Acquisition Category and DOT&E oversight program tests. However, USAISC, USAHSC, USAINSCOM, and others are designated as the operational tester for spec ic programs.

(4) Preparation of the OTP begins following approval of the requirements document and a request from the Project Manager/Program Executive Officer to OPTEC for evaluator and tester members for the TWIG. OPTEC establishes OTP milestones concurrent with the assignment of testers and evaluators. Final TSARC approval of the OTP should take place no later than 24 months before test execution and in no case less than one year prior to execution. These milestones are critical to align testing and unit training objectives and minimize adverse effects of testing on user test unit and personnel readiness.

(5) Test requirements that do not allow the one-year notification can only be approved on an exception basis by submitting a proposed OTP to the Chairman of the TSARC (OPTEC Commander) for "Out-of-Cycle" coordination by the TSARC members and subsequent approval by DA DCSOPS. Such a submission can only be submitted by a memo of transmittal, signed by a General Officer TSARC member.

(6) No OTP will approved without an Army approved TEMP.

c. The TSARC establishes priorities among the tests, resolves resource issues and conflicts, and presents a prioritized package of OTPs to the DA DCSOPS for approval. Once approved the compendium of OTPs are taskers for test support and collectively are known as the Army's current FYTP. The priority lists become guidelines whereby supporting commands apply limited resources in rank order. The approved FYTP is published and distributed by OPTEC semiannually.

d. The TSARC is supported by two working group sessions that introduce new requirements, revise current plans as needed, and develop and work on test support issues. These Initial TSARC Working Group and Mid-Cycle Working Group sessions are chaired by the DCSOPS of OPTEC. (See figure 4-2, TSARC Process.) Detailed procedures of the working groups and the General Officer TSARC are provided in the TSARC Handbook published by OPTEC. The charter, scope, membership and responsibilities of the TSARC are provided in AR 15-38. (See figure 4-3, TSARC Membership.)

e. All the types of test mentioned in the TEMP paragraph above will be included in FYTP. This includes any developmental or operational tests that require test support assets outside the OTP proponent command and included in the generic definition of OT. These include all of the categories discussed below.

(1) Developmental Test (DT). The majority of TT are not included in the TSARC/FYTP processes as they are conducted solely from within the resources of the Materiel Developer. However, for those that require resources not controlled by the Materiel Developer (e.g., user troops, and non-materiel developer installations or facilities, who's use compete against other FYTP requirements), must be submitted for approval and prioritization into the FYTP. AMC representatives normally submit and coordinate these requirements in the TSARC process and provide funding to supporting commands as required.

(2) FDTE. These are conducted early in the acquisition process for materiel systems, and for non-materiel acquisition,

as desired by the combat and training developers to examine the effectiveness of existing or proposed concepts of training, logistics, doctrine, organization, and materiel. FDTE may be used to determine essential and desirable capabilities or characteristics of proposed systems or can assist in refining concepts of employment, logistics, training, organization, or personnel. The CBTDEV or TNG DEV is the proponent for such tests. Accordingly, TRADOC introduces these types of tests into the TSARC process and provides funding support for the test as required. OPTEC normally conducts these tests providing evaluation support as agreed to in a mutual memorandum of understanding with TRADOC.

(3) EUTE. This is a generic type of operational test encompassing all system focus tests employing representative user troops during the demonstration validation phase prior to Milestone II. The purpose of the EUTE is to test a materiel concept, support planning for training and logistics, identify inter-operability problems, and/or determine future testing requirements. The TIWG must identify the test need in the TEMP and OPTEC is responsible for introducing the OTP into the TSARC process, RDTE funding for test costs (see Figure 4-2), and conduct of the test and evaluation.

(4) LUT. The LUT is a generic term encompassing all RDTE funded operational testing between Milestone II and Milestone III that is not a part of IOTE. These test address limited user and operational issues and are normally limited to a single issue. The TIWG must identify the test need in the TEMP and OPTEC is responsible for introducing the OTP into the TSARC process, RDTE funding for test costs (see figure 4-2), and conduct of the test and evaluation.

(5) IOT. The IOT is a field test, under realistic operational conditions, of a production-representative system for determining its operational effectiveness and suitability for use by typical users in combat or when otherwise deployed. The TIWG must identify the test need in the TEMP and OPTEC is responsible for introducing the OTP into the TSARC process, RDTE funding for test costs (see figure 4-2), and conduct of the test and evaluation.

(6) FOT. These tests are conducted subsequent to a decision to procure an emerging combat system to evaluate required fixes noted in IOT or CE. The operational evaluator determines the need for such test and OPTEC is responsible for introducing the OTP into the TSARC process, OMA funding for test costs (see figure 4-2), and conducting and evaluating the test.

f. FYTP Prioritization Process. Along with the proposed FYTP, the TSARC provides priority lists for current and budget fiscal years operational testing. The lists provide Army guidance for the relative priorities of tests for resources.

(1) OPTEC develops draft priority lists prior to the TSARC Mid-Cycle Working Group meeting. The drafts contain all tests submitted to the Initial TSARC Working Group for the current and budget fiscal years. DA DCSOPS provides guidance concerning prioritization focusing on emerging systems designed to overcome critical Army battlefield deficiencies.

(2) TSARC members provide input and final draft priority lists are developed at the Mid-Term TSARC Working Group meeting. OPTEC makes final coordination and final drafts are presented for approval at the General Officer TSARC meeting. Subsequent to DA DCSOPS approval, the lists are published by OPTEC along with the new FYTP.

(3) Priority lists are then used by test support providers as general guidance for the applications of limited resources. Once approved the Army's FYTP and the OTPs contained in it, become taskers for testing support. Because tests occur at different times and in some cases there are more demands than resources, resource providers must manage meticulously. Insupportable taskings should be brought to the attention of DA DCSOPS (DAMO-FDT) as soon as they are discovered.

g. Operational Test Readiness Reviews (OTRR). FYTP tests are scheduled for review by the Commander, OPTEC or other OT&E activities to identify problems, make changes in test preparations as required, and culminate in a go/no go decision by the Commander, OPTEC or his designated representative as to the systems readiness for test. OTRR procedures are detailed in chapter 8.

h. Test and Evaluation Principles. To maximize the return on resources committed to test and evaluation, promote continuity and mutual benefits between testing and training, and minimize the impact on readiness of user troops who participate in OT&E, the TSARC/FYTP processes seek to adhere to the following principles.

(1) Minimize the effects of operational testing on units; correlate testing and training management processes; assure at least one year notification to units involved in testing; and test where test units are stationed.

(2) Test with the first units equipped (FUE): this allows the practical benefits of training on new equipment by those who will first have to use it; and enhances the readiness of the unit with the introduction of the emerging combat system.

(3) Test smart by using simulations and models where feasible: these can save troops required, time required, allows interactive test and evaluation, and allows test and evaluation of concepts not possible with the current force.

(4) Combine tests where feasible: combining FDT&Es and IOT&Es, and TTs and operational tests have proven to save resources and expedite the T&E process.

(5) Use the minimum essential resources to achieve adequacy, quality and credibility: test against COIC challenging additions at every opportunity.

(6) Maintain the independence of testers and evaluators: conduct OT&E in cooperation with the materiel and combat developers, but separate in terms of control of OT&E resources and participation in OT&E efforts.

4-6. Concept Evaluation Program (CEP) and Customer Test (CT) Support

In many instances, combat and materiel developers have need for test support to evaluate concepts or innovations prior to a materiel solution to modernization needs being developed. OPTEC (TEXCOM) and AMC (TECOM) support these needs categorized as CEP tests or CTs on a, as feasible and reimbursable, basis. Because they are usually small, short notice, and do not compete with FYTP resources, CEP and CT coordination and support are planned and executed outside the FYTP/TSARC processes.

a. CEP. The CEP is a TRADOC program to provide quick reaction and innovative evaluation to resolve combat and training development issues.

(1) A TRADOC CEP Schedule and Review Committee (CEPSARC), similar to the TSARC in function, meets semiannually to approve and prioritize CEP requirements. Priorities are then provided to supporting commands for tester assignment.

(2) Because of the nature of CEPs, direct coordination with the tester headquarters is encouraged. For OPTEC supported CEP tests, a resume sheet delineating support requirements (see figure 4-4) is required.

(3) TRADOC is responsible for funding support of CEP tests which involve RDTE funds specifically programmed and budgeted for CEPs by DA.

b. CT. Customer tests is a generic category to accommodate all other operational testing needs not provided for in the FYTP or CEP processes. The basis of test support and coordination is the same as for CEP tests. The only difference is in tester priority, wherein CTs are lower priority than CEP tests and therefore, if there is a test resource conflict, CTs must be coordinated around other requirements.

c. To facilitate test and evaluation support for CEP and Cts, OPTEC has established Test and Evaluation Coordination Offices (TECO) at TRADOC locations (i.e., Fort Benning, Fort Knox, Fort Lee, Fort Leonard Wood, Fort Rucker, and Fort Gordon). The TECOs along with TEXCOM Headquarters at Fort Hood, and other OPTEC test directorates at Fort Bragg, Fort Huachuca, Fort Sill, and Fort Hunter Liggett provide informal assistance for customer test planning and coordination. Submittal of formal requests for support are required to HQ OPTEC (ODCSOPS-TMD) so overall requirements can be taken into consideration and formal internal taskings conducted.

4-7. Instrumentation

Management of user test instrumentation is accomplished through the User Test Instrumentation Program (UTIP). The UTIP describes consolidates and priorities instrumentation projects. It also documents OPTEC command decisions relating to funding levels and priorities. UTIP projects are classified as major, non-major, and sustaining instrumentation.

a. Major instrumentation is defined as instrumentation that has a joint service application, multiple command requirement, requires high visibility, or a total life cycle cost of $5M and above (present year dollars). These systems typically provide new capabilities or significant upgrades to existing capabilities.

b. Non-major instrumentation is defined as instrumentation having a total life cycle cost of less that $5M and is not classified as major. These systems typically include test specific instrumentation and upgrades or enhancements to existing assets. Sustaining instrumentation is defined as repair, maintenance, or replacement of current inventory. Sustaining instrumentation costs will not exceed $15K Research, Development, Test and Evaluation (RDTE) or $100K combined RDTE and Other Procurement, Army (OPA).

c. To acquire new instrumentation, requirements are presented at either of the semiannual Instrumentation Requirements Conferences. Instrumentation requirements conferences are hosted semiannually in May and November each year to prepare the UTIP for execution and for entry into the POM cycle. Topics of discussion will include (but not limited to) policy/procedural changes, current funding, fiscal planning guidelines, and anticipated test data requirements that may significantly impact present or future instrumentation development programs. This conference provides a forum for testers to propose instrumentation development projects to satisfy its future test needs and to provide a peer review of other candidate projects. All submissions will contain a need statement, instrumentation description, estimated funding requirements and justification. Projects will be reviewed for results of the economic analysis, unnecessary duplication, commonality, interoperability and compatibility with the instrumentation inventory data base. Conference results will be provided to OPTEC.

d. OPTEC Command Review Committee is chaired by OPTEC and composed of Colonel (O6) level representation, to review and to assure that instrumentation programs support long term OT&E plans and are in concert with TSARC test priority guidance. The review committee will either approve projects for funding consideration or return it to proponent for resubmission (if applicable) at next cycle. Committee will determine funding level for each approved project and its priority. The committee's decisions will be documented and distributed as minutes of the review committee and will serve as the basis for the formulation of the UTIP. Upon approval, the UTIP becomes the OPTEC instrumentation master plan.

e. OPTEC will provide the approved UTIP to the Program Manager for Instrumentation, Targets and Threat Simulators (PM-ITTS) for review. Major instrumentation projects will be prioritized and presented by PM-ITTS to the General Officer Steering Council for ITTS approval, funding and program execution. OPTEC will appoint a user representative to monitor project activity and contract performance. When required, a Users Group will be established with chair designated by OPTEC to elicit changes and provide recommended program changes to OPTEC command.

4-8. OT&E Funding

This section delineates funding processes and responsibilities of OT&E. Generally, OPTEC plans, budgets, and programs for the majority of FYTP execution less FDTE (TRADOC), TT (AMC) and selected other command sponsored tests; TRADOC is responsible for

CEP tests; and the customer bears responsibility for CT. A quick reference to test and evaluation funding by type T&E activity, appropriation, and command responsibility is provided in figure 4-5. Generally, operational test, test support items and CE activities are funded as follows:

a. Operational Tests. IOT&E on a system is usually funded from RDTE appropriations, Category 6.5 funds. FOT&E is normally funded from OMA funds (AR 70-10).

b. Continuous Evaluation (CE). CE, to include analysis, modeling, and simulation proposed by the evaluator, is funded from OMA funds.

c. Concept Evaluation Program (CEP). Testing for concept evaluation is done using RDTE funds for materiel development and with OMA funds for combat developments (AR 70-10).

d. Multiservice tests. Costs for Army related portions of multi-service tests are funded from the RDTE appropriation if testing occurs before the decision to enter full production. Costs for testing after the full production decision are funded from the OMA appropriation.

e. Special tests. Special operational tests, such as special access program tests, may be specifically requested by DA or higher organizations. Such tests would not normally be included in initial TEMP planning nor in an OTP. In such an instance, the tester will require identification of funding sources from the test requester.

f. Customer tests. Normally combat developers, but others as well, may request OPTEC or TECOM support limited, short-notice tests for any reason. These assume that all external support requirements will be coordinated by the customer and the variable test costs (see figure 4-2) will be reimbursed by the customer.

g. Ammunition. Consumable rounds of standard ammunition and tactical missiles required in support of operational testing are provided by the procurement appropriation or from existing inventory, on a priority basis without reimbursement. For all short-supply conventional ammunition, the Committee for Ammunition Logistics Support (CALS) allocates and prioritizes all ammunition and pyrotechnics including test requirements. As a user test representative, OPTEC is a member of the CALS. Developmental ammunition and missiles required to support operational testing are identified early in the program and

financed through the RDTE appropriation of the system's materiel developer.

h. User Test Flying Hour Program. OPTEC manages this program which allocates flying hours to test agencies in support of operational testing. The basis for flying hour allocations is the flying hour requirements reflected in OTPs in approved FYTP. OPTEC submits reports as outlined in AR 95-33, Army Aircraft Inventory, Status, Flying Time, and the TSARC Handbook.

i. Integrated Logistics Support Plan (ILSP). The ILSP is prepared, coordinated, and approved by the Materiel Developer. Resource requirements for operational testing of logistics supportability are incorporated into the OTP by the operational testing activity. The RDTE funds required to support ILS test plans are listed in the Support Resource Funds section of the ILSP.

j. OT&E Inputs to the Planning, Programming, Budgeting, and Execution System (PPBES). Inputs to the PPBES from OT&E go to DA in one of two submissions from the command: The Program Analysis Resource Review (PARR) and the Command Operating Budget (COB). Program Decision Increment Packages (PDIP) describing operational tester requirements for RDTE appropriations are extracted from the PARR at DA level and input to the Long-Range, Research, Development and Acquisition Plan (LRRDAP). The LRRDAP and the FYTP are inputs to ASA(RDA) guidance on COB preparation by the OT&E activity. OT&E is costly and every effort must be made to conserve.

(1) Funding requirements must be identified as far forward as possible. The TSARC/FYTP processes are dynamic in that OTP are modified in each cycle to reflect funding refinements. Although the tester has principal responsibi ty for documenting requirements in OTP, many others must provi nput to capture all costs as quickly as possible.

(a) Overall programming and budgeting is accomplished by ASA(RDA) and DA DCSCOPS required to conduct OT. ASA(RDA) provides RDTE funding, while DA DCSOPS provides OMA funding. Both of these appropriations are used to support OT depending on the phase of development in which testing is performed. If testing is performed in the development stage, then it is funded through RDTE appropriation; however, if testing occurs in the production phase, the funding is OMA.

(b) The TIWG must identify types of test to be conducted; and the long lead items (e.g., instrumentation, threat

systems,targets, simulators, modeling), size and type of test units involved, test articles, support equipment, training requirements, and estimated funding required for each in the TEMP. Remember that OTP without Army approved TEMP are withdrawn from the FYTP by the TSARC as not executable.

(c) The Combat Developer's COIC drive test requirements more than any other element of OT&E. The number of tests, the of event repetitions, length, etc., are contingent on the COIC and the AOIC developed by the operational evaluator. Expeditious approval of both the COIC/AOIC are essential to resource planning and programming.

(d) DOTE and DUSA(OR) review and approval of test and evaluation concepts for major and oversight systems in many instances add significant resource requirements to scheduled tests late in the OTP development process. These unprogrammed additions must receive the closest scrutiny and if warranted be provided to the operational tester at the earliest possible time.

(e) The major cause of test cost increases and negative impacts on user units involved in operational testing is late realization that test articles will not be ready. It is incumbent on the PM/PEO to notify the T&E community at the earliest possible time that a system will not be ready to go to test. Any test slip costs dollars, and the closer to the test date and longer the slip, the more it costs. Test unit training schedules become disrupted and therefore their readiness with unplanned requirements to support OT&E. The more advanced notice received of an impending slip in availability of test articles, the less the impact on costs and test units.

CLASSIFICATION

OTEMS VERSION

OUTLINE TEST PLAN (OTP)

TYPE SUBMISSION
DATE

TESTER: OFFICE: DSN:
EVALUATOR: OFFICE: DSN:

TEST TITLE:
TEST TYPE:
ACQUISITION MILESTONE SUPPORTED:
ACQUISITION CAT: ____________ DECISION REVIEW: ____ DOD OVERSIGHT: ____
TEST AUTHORITY: ____________ T&E MGMT: __________
COMBAT DEVELOPER:
MATERIEL DEVELOPER:
DA STAFF PROPONENT:
TEST ORGANIZATION:
TEST UNIT:
TEST LOCATION:
TEST DATES: START: __________ COMPLETION: __________ RESOURCE: __________
AMMO: ___ AVN HRS: ___ CONTR: ___ INST: ___ SIM: ___ TGT: ___ TGT SIM ___
TOTAL DIRECT TEST AND EVALUATION COSTS (IN THOUSANDS):

PROG BY	APPN	FY ____	FY ____	FY ____	FY ____
_____	_____	0.0	0.0	0.0	0.0

1. REFERENCES:
   A. Requirement/Tasking Document(s).
   B. TEMP.
   C. Waivers.
   D. Previous Testing.
   E. Planned Future Tests.
2. PURPOSE/FUNCTIONAL DESCRIPTION.
   A. Purpose.
   B. Functional Description.
3. CRITICAL OPERATIONAL ISSUES (COI).
4. SCOPE AND TACTICAL CONTEXT.
   A. Scope.
   B. Tactical Context.
5. IMPACT STATEMENTS.
   A. Environmental, Laser and Energy Implications.
   B. Training Implications.
   C. SIGSEC/OPSEC Implications.
   D. Human Volunteers.
   E. Radionuclides Certification.

XXXX-XX-XXXX-XXXXA-1
(CLASSIFICATION)

FIGURE 4-1

CLASSIFICATION

6. OTHER RESOURCES REQUIRED.
   A. Support Packages.
   B. System Safety (Requirements/Releases).
   C. Photographic Support.
   D. Contractor Studies or Support.
   E. Meteorological Support.
   F. Security Requirements.
   G. Other.
7. POINTS OF CONTACT

SECTION I
TEST RESOURCE REQUIREMENTS

1. TEST DIRECTORATE.
   A. Personnel Requirements.
   B. Equipment Requirements.
2. PLAYER PARTICIPANTS.
   A. Personnel Requirements.
      (1) Individual Personnel.
      (2) Unit/Element Personnel.
   B. Equipment Requirements.
3. ITEM(S) TO BE TESTED.
   A. Test Items.
   B. Support Requirements.
4. DATA COLLECTION/ADP SUPPORT.
   A. Data Collection/Processing System.
   B. ADP Facility Support.
   C. Contractor or Other Government Agencies.
5. AMMUNITION, MISSILES, AND PYROTECHNICS.
   A. Ammunition and Pyrotechnics.
   B. Missiles.
6. PETROLEUM, OILS, AND LUBRICANTS (POL) SUPPLIES.
7. INSTRUMENTATION.
   A. Equipment.
   B. Contractor or Other Government Agencies.
8. TEST FACILITIES/INSTALLATION SUPPORT.
   A. Test Facility Range Support.
   B. Communication/Engineering Support.
   C. Installation Support.
   D. Other Support.
9. THREAT SIMULATORS/OTHER SIMULATORS/TARGET VEHICLES.
   A. Threat Simulators.
   B. Other Simulators.
   C. Target Vehicles.
10. FLYING HOURS SUPPORT.

XXXX-XX-XXXX-XXXXA-1
(CLASSIFICATION)

Figure 4-1. (cont)

CLASSIFICATION

SECTION II

EVALUATION RESOURCE REQUIREMENTS

1. PERSONNEL REQUIREMENTS.
2. EQUIPMENT REQUIREMENTS.
3. ADP SUPPORT REQUIREMENTS.
4. INSTRUMENTATION REQUIREMENTS.
5. FACILITIES SUPPORT REQUIREMENTS.

SECTION III

TEST MILESTONES/CONTRACT SUMMARY

1. MILESTONES.
2. CONTRACT REQUIREMENTS SUMMARY.

XXXX-XX-XXXX-XXXXA-1

(CLASSIFICATION)

Figure 4-1. (cont)

CLASSIFICATION

SECTION IV
TEST COST ESTIMATES

1. EVALUATION COSTS ESTIMATES (IN THOUSANDS).

TEST NUMBER: XXXX-XX-XXXX-XXXXA DATE PREPARED: DD MMM YYYY
TEST TITLE: XXXXXXXXXXXXXXXXXXXXX
TEST TYPE: XXXXXXXXXXXXXXXXXXXXX

CATEGORY OF COST	PROG BY	APPN	FY____	FY____	FY____	FY____
(a) CIVILIAN HIRE (CIV PAY)	XXXX	XXXX	0.0	0.0	0.0	0.0
(b) CIVILIAN OVERTIME	XXXX	XXXX	0.0	0.0	0.0	0.0
(c) TDY (EVALUATION)	XXXX	XXXX	0.0	0.0	0.0	0.0
(e) LEASE/RENTAL-COMMO/UTIL	XXXX	XXXX	0.0	0.0	0.0	0.0
(f) CONTRACTS	XXXX	XXXX	0.0	0.0	0.0	0.0
(h) SUPPLIES/MATERIEL	XXXX	XXXX	0.0	0.0	0.0	0.0
(i) EQUIPMENT	XXXX	XXXX	0.0	0.0	0.0	0.0
(j) INSTRUMENTATION	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVAL COST PROG BY	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVALUATION COSTS			0.0	0.0	0.0	0.0

XXXX-XX-XXXX-XXXXA-1
(CLASSIFICATION)

Figure 4-2.

CLASSIFICATION

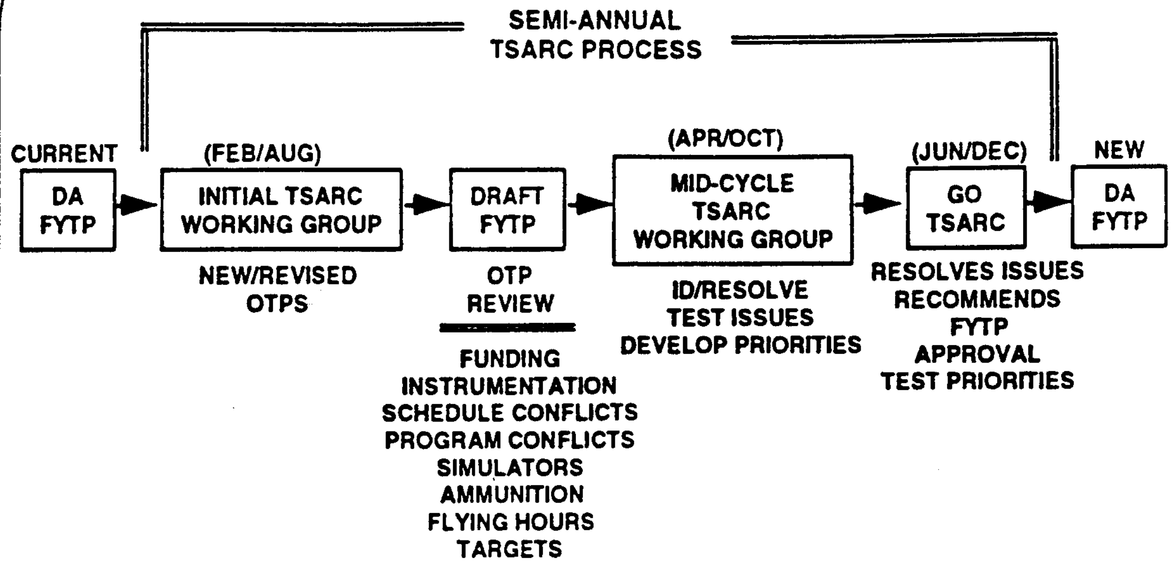
2. DIRECT TEST COSTS ESTIMATES (IN THOUSANDS).

TEST NUMBER: XXXX-XX-XXXX-XXXXA   DATE PREPARED: DD MMM YYYY
TEST TITLE: XXXXXXXXXXXXXXXXXXXXX
TEST TYPE: XXXXXXXXXXXXXXXXXXXXX

CATEGORY OF COST	PROG BY	APPN	FY____	FY____	FY____	FY____
(a) CIVILIAN HIRE (CIV PAY)	XXXX	XXXX	0.0	0.0	0.0	0.0
(b) CIVILIAN OVERTIME	XXXX	XXXX	0.0	0.0	0.0	0.0
(c) TDY (EVALUATION)	XXXX	XXXX	0.0	0.0	0.0	0.0
(d) TRANSPORT OF TEST ITEM	XXXX	XXXX	0.0	0.0	0.0	0.0
(e) LEASE/RENTAL-COMMO/UTIL	XXXX	XXXX	0.0	0.0	0.0	0.0
(f) CONTRACTS	XXXX	XXXX	0.0	0.0	0.0	0.0
(g) POL	XXXX	XXXX	0.0	0.0	0.0	0.0
(h) SUPPLIES/MATERIEL	XXXX	XXXX	0.0	0.0	0.0	0.0
(i) EQUIPMENT	XXXX	XXXX	0.0	0.0	0.0	0.0
(j) INSTRUMENTATION	XXXX	XXXX	0.0	0.0	0.0	0.0
(k) THREAT SIMULATORS	XXXX	XXXX	0.0	0.0	0.0	0.0
(l) OTHER SIMULATORS	XXXX	XXXX	0.0	0.0	0.0	0.0
(m) TARGETS	XXXX	XXXX	0.0	0.0	0.0	0.0
(n) ARMY AVIATION SUPPORT COST	XXXX	XXXX	0.0	0.0	0.0	0.0
(o) OTHER SERVICES DIRECT SPT	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL DIRECT COST PROG BY	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL DIRECT TEST COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVAL COST PROG BY	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVALUATION COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0
(p) OTHER SERVICES SPT COST	XXXX	XXXX	0.0	0.0	0.0	0.0
(q) AMMUNITION COST	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL TEST COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0

XXXX-XX-XXXX-XXXXA-1
(CLASSIFICATION)

Figure 4-2. (cont)



TEST SCHEDULE AND REVIEW COMMITTEE

CDR, OPTEC - CHAIRMAN

ODCSOPS	ODISC4	ODCSLOG
ODCSPER	ODCSINT	OTSG
ASA (RDA)	ASA (FM)	AMC
TRADOC	FORSCOM	USAREUR
USARPAC	USASOC	USAISC
INSCOM		

TECOM, TEXCOM, ISEC, HSC - MAY PROVIDE REPRESENTATIVES.

OTHER STAFF AGENCIES/ARMY COMMANDS ARE INVITED WHEN TEST PROGRAMS FALL IN THEIR FUNCTIONAL AREA OF RESPONSIBILITY OR INVOLVE THEIR RESOURECES.

FIGURE 4-3

CLASSIFICATION

OTEMS VERSION — RESUME SHEET (RS) — DATE

TESTER: OFFICE: DSN:

TEST TITLE: CRC: ____________
TEST TYPE:
TEST AUTHORITY: ____________
COMBAT DEVELOPER:
TEST ORGANIZATION:
TEST UNIT:
TEST LOCATION:
TEST DATES: START: ____________ COMPLETION: ____________ RESOURCE: ____________
AMMO: ____ AVN HRS: ____ CONTR: ____ INST: ____ SIM: ____ TGT: ____ TGT SIM ____
TOTAL DIRECT TEST AND EVALUATION COSTS (IN THOUSANDS):

PROG BY	APPN	FY _____	FY _____	FY _____	FY _____
_____	_____	0.0	0.0	0.0	0.0

THESE FIELDS ARE EMPLOYED FOR CEPS ONLY

TEST AUTHORIZATION	TEST TIMEFRAME	PROPONENT PRIORITY
1. _ DA DIRECTED/ON-GOING	1. _ WITHIN 1 QTR	1. _ 1
2. _ TRADOC DIRECTED	2. _ WITHIN 2 QTRS	2. _ 2
3. _ MAA DEFICIENCY	3. _ WITHIN 3 QTRS	3. _ 3
4. _ BDP DEFICIENCY	4. _ WITHIN 4 QTRS	4. _ 4
5. _ MAT'L RQMT/DOTL	5. _ OVER 1 YR.	5. _ OTHER
6. _ NEW IDEA		

1. REFERENCES:
   A. Requirement/Tasking Document(s).
   B. TEMP.
   C. Waivers.
   D. Previous Testing.
   E. Planned Future Tests.
2. PURPOSE/FUNCTIONAL DESCRIPTION.
   A. Purpose.
   B. Functional Description.
3. CRITICAL OPERATIONAL ISSUES (COI).
4. SCOPE AND TACTICAL CONTEXT.
   A. Scope.
   B. Tactical Context.

XXXX-CP-XXXX-XXXXA-1
(CLASSIFICATION)

FIGURE 4-4.

5. IMPACT STATEMENTS
   A. Environmental, Laser and Energy Implications.
   B. Training Implications.
   C. SIGSEC/OPSEC Implications.
   D. Human Volunteers.
   E. Radionuclides Certification.

6. OTHER RESOURCES REQUIRED.
   A. Support Packages.
   B. System Safety (Requirements/Releases).
   C. Photographic Support.
   D. Contractor Studies or Support.
   E. Meteorological Support.
   F. Security Requirements.
   G. Other.

7. POINTS OF CONTACT.

SECTION I
TEST RESOURCE REQUIREMENTS

1. TEST DIRECTORATE.
   A. Personnel Requirements
   B. Equipment Requirements
2. PLAYER PARTICIPANTS.
   A. Personnel Requirements
      (1) Individual Personnel.
      (2) Unit/Element Personnel.
   B. Equipment Requirements
3. ITEM(S) TO BE TESTED.
   A. Test Items.
   B. Support Requirements.
4. DATA COLLECTION/ADP SUPPORT.
   A. Data Collection/Processing System.
   B. ADP Facility Support.
   C. Contractor or Other Government Agencies.
5. AMMUNITION, MISSILES, AND PYROTECHNICS.
   A. Ammunition and Pyrotechnics.
   B. Missiles.
6. PETROLEUM, OILS, AND LUBRICANTS (POL) SUPPLIES.
7. INSTRUMENTATION.
   A. Equipment.
   B. Contractor or Other Government Agencies.

Figure 4-4. (cont)

8. TEST FACILITIES/INSTALLATION SUPPORT.
   A. Test Facility Range Support.
   B. Communication/Engineering Support.
   C. Installation Support.
   D. Other Support.
9. THREAT SIMULATORS/OTHER SIMULATORS/TARGET VEHICLES
   A. Threat Simulators.
   B. Other Simulators
   C. Target Vehicles.
10. FLYING HOURS SUPPORT.

SECTION II
TEST MILESTONES/CONTRACT SUMMARY

1. MILESTONES.
2. CONTRACT REQUIREMENTS SUMMARY

Figure 4-4. (cont)

CLASSIFICATION

1. DIRECT TEST COSTS ESTIMATES (IN THOUSANDS).

TEST NUMBER: XXXX-CP-XXXX-XXXXA DATE PREPARED: DD MMM YYYY
TEST TITLE XXXXXXXXXXXXXXXXXXXXX
TEST TYPE: XXXXXXXXXXXXXXXXXXXXX

CATEGORY OF COST	PROG BY	APPN	FY____	FY____	FY____	FY____
(a) CIVILIAN HIRE (CIV PAY)	XXXX	XXXX	0.0	0.0	0.0	0.0
(b) CIVILIAN OVERTIME	XXXX	XXXX	0.0	0.0	0.0	0.0
(c) TDY (EVALUATION)	XXXX	XXXX	0.0	0.0	0.0	0.0
(d) TRANSPORT OF TEST ITEM	XXXX	XXXX	0.0	0.0	0.0	0.0
(e) LEASE/RENTAL-COMMO/UTIL	XXXX	XXXX	0.0	0.0	0.0	0.0
(f) CONTRACTS	XXXX	XXXX	0.0	0.0	0.0	0.0
(g) POL	XXXX	XXXX	0.0	0.0	0.0	0.0
(h) SUPPLIES/MATERIEL	XXXX	XXXX	0.0	0.0	0.0	0.0
(i) EQUIPMENT	XXXX	XXXX	0.0	0.0	0.0	0.0
(j) INSTRUMENTATION	XXXX	XXXX	0.0	0.0	0.0	0.0
(k) THREAT SIMULATORS	XXXX	XXXX	0.0	0.0	0.0	0.0
(l) OTHER SIMULATORS	XXXX	XXXX	0.0	0.0	0.0	0.0
(m) TARGETS	XXXX	XXXX	0.0	0.0	0.0	0.0
(n) ARMY AVIATION SUPPORT COST	XXXX	XXXX	0.0	0.0	0.0	0.0
(o) OTHER SERVICES DIRECT SPT	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL DIRECT COST PROG BY	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL DIRECT TEST COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVAL COST PROG BY	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL EVALUATION COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0
(p) OTHER SERVICES SPT COST	XXXX	XXXX	0.0	0.0	0.0	0.0
(q) AMMUNITION COST	XXXX	XXXX	0.0	0.0	0.0	0.0
TOTAL TEST COSTS	XXXX	XXXX	0.0	0.0	0.0	0.0

XXXX-CP-XXXX-XXXXA-1
(CLASSIFICATION)

Figure 4-4. (cont)

OT&E FUNDING

	OPTEC	TRADOC	AMC	CUSTOMER	DOD
EUTE, LUT, IOT&E	RDTE				
FOT&E	OMA				
FDT&E		OMA OR RDTE			
CEP		RDTE OR OMA			
CT				OMA OR RDTE	
MIOT&E	RDTE				
JT&E	OMA				OMA
TT&E			RDTE		

FIGURE 4-5.

4/7/92

Chapter 5
Test Execution

Section I
General

5-1. Introduction to test execution
The operational tester mission is to plan, execute, and report OT. This mission is accomplished through a structured approach to developing plans and procedures to meet the test requirements. These plans and procedures are identified and performed IAW a sequence of steps dependent upon time phasing within overall test milestones. Each period of time phasing, or a test phase, requires specific actions to be accomplished by participants and appropriate test documentation to be produced that contains the procedures for the OTE that have been developed. Each of these test phases address a specific time period during the overall OT process. The six functional phases are:

a. Preliminary Analysis and Planning Phase. See Chapter 3.

b. Test Design Planning Phase. See Chapter 3.

c. Detailed Test Planning Phase. See below and Section III.

d. Test Execution Phase. See below and Section XV.

e. Data Reduction and Analysis Phase. See below and Sections XVIII through XXIII.

f. Report Writing and Publishing Phase. See Chapter 6.

5-2. Detailed test planning phase
This phase of the planning process expands and finalizes the detailed procedures that will be used during the test execution and reporting phases. Following publication of the approved TEP, the operational tester, in conjunction with the test proponent and other appropriate commands and agencies, develops the DTP. The DTP translates, as required, the test design contained in the TEP into specific instructions for the actual conduct of test. Test control, data management, training, and test support requirements and procedures are finalized in the DTP. DTP are for internal use of the operational tester, but may be provided to interested government agencies for information.

5-3. Test execution phase

During this phase, planned events are conducted and data are collected and recorded. Deviations from planned events are documented. The products of this phase are comprehensive data obtained IAW the planned test methodology which will be used to address the test issues.

5-4. Data reduction and analysis phase
Data reduction includes the transfer of data from raw form to data bases or the processing of data collected with test instrumentation IAW preplanned procedures and methodology. Data reduction may begin during the test execution phase and results in an authenticated level 3 data base to meet analysis requirements. This data base will be employed for the application of techniques to produce descriptive statistics. Data analysis consists of performing tests and analytic techniques which translate the data into meaningful results (findings, assessments, and suggested improvements).

Section II
Test Organization

5-5. Test Directorate
OT is conducted by a structured test directorate typically consisting of a test director, deputy test director, test officer, test analyst, test directorate personnel provided as specified in the OTP, and selected units. A typical test unit or organization structure is discussed below, however, the configuration varies depending on the size of the test and whether the system is full evaluate or abbreviated evaluate or whether the OT is another type of user test.

5-6. Test team organization
The organization of the test team is tailored to fit the size, scope, duration, and importance of the test. Careful thought must be exercised to ensure optimum staffing to accomplish each task. The test team must be adequate in size to function for the duration of the test and man the number of different shifts required by the test schedule. For control purposes, the test team is broken down into two basic divisions of test organization personnel and test player personnel. The following subelements comprise a test team:

a. Test Director/Deputy Test Director.

b. Test Officer/Deputy Test Officer/Test NCOIC.

c. Administrative Officer/Secretary and Administrative Element.

d. Protocol/Visiter Control/Briefing Officer.

e. Test Analyst and Analytic Element (including MANPRINT, RAM, and Software).

e. Test Operations Officer and Operations Element.

f. Chief Controller and Control Element (including Threat Manager).

g. Chief Data Collector and Data Collection Element (including MANPRINT, RAM, and AV).

h. Chief Instrumenter and Test Instrumentation and Telemetry Element.

i. Data Manager and Data Management Element (including ADP Manager).

j. Chief of Site Support and Test Support Element.

k. Troop Commander and Test Player Troops.

l. Troop Commander and OPFOR Player Troops.

m. Deputy Test Directors for Doctrine, Training, and Logistics (normally provided by TRADOC or other outside activity).

n. MATDEV Site Director and MATDEV Test Support Team (includes contractor maintenance personnel where appropriate).

o. Chief Evaluator and Evaluator Task Force.

p. Data Authentication Group (DAG)

5-7. Tailoring the test team
The test team outlined above represents a very large test. On a small test, many of the jobs can be combined. The test director may only provide general supervision and the test officer provides all day-to-day direction of the test. The test NCOIC may take charge of administration and protocol. The deputy test officer, operations officer, and chief controller may be the same person. Each team should be planned based on need and not based on a prescribed structure.

5-8. Test Officer

a. For larger tests, the test officer may be assisted by assistant test officers for specific areas. Each assistant is responsible to his organization for the validity of the appropriate aspects of the test. Actual day-to-day test operations are conducted under the supervision and management of the test officer. The test officer is responsible for validating test procedures and for preparing the test report. (See chapter 3 of the TEP.)

b. The progress and ultimate success of a test depend upon prior planning, support provided, proficiency of participants, and the knowledge and leadership of the test officer. The job of the test officer is a difficult one as no single formula applies to all tests.

c. Tests must be flexible and tailored to support the evaluation of the system or concept. In theory, if all the elements of the test planning phase are feasible and properly documented in the TEP and the DTP, test execution should be a smooth process. In practice, however, unforeseen technical and/or administrative difficulties nearly always occur.

d. While making every possible effort to follow the test design procedures, the test officer must also be flexible enough to adjust the program so it can deal with unforeseen problems and test anomalies, such as periods of lowered player motivation, instrumentation failure, loss of key personnel on emergency leave, or absence of key repair parts for the tested prototype. This approach will optimize the chances of success. It is important for the test officer to ensure that the principal agencies affected by any change (proponent and support activities) are properly informed and concur with the proposed change.

Section III
Detailed Test Plan (DTP)

5-9. General
The purpose of the DTP is to supplement the TEP, as required. The DTP provides detailed instructions, missions, tasks, organization, and procedures necessary for test execution, data reduction and analysis, and preparation of the test report and associated materials. It serves as an informal "living" document that is changed and updated as required. It does not require publication or formal approval unless directed in the TEP.

a. There are two primary sources of information for detailed test planning: the TEP and the OTP. The DTP is an extension of the TEP process. DTP efforts may feed back into the TEP. This iterative process continues through the various drafts until the DTP is developed.

b. Development of the support plans appendices to the DTP should move consistently toward more detail, in parallel with refinement of the TEP and OTP, and should not wait on revisions to be published. These plans become a part of the DTP.

c. The TEP contains information for detailed planning by discussion of anticipated requirements and documented concepts. Chapter 3 of the TEP also contains some of the most important information upon which to build further planning,

d. The OTP contains material on all DTP supporting plans. Section 1.0, Part 7 of the OTP defines test resource requirements for instrumentation support. "Direct Cost Estimates" section of the OTP contains information on AV support under Part 6 - "Test Facilities/Installation," and under Part 7 - "Other Resources Required." Section 1, Part 4 of the OTP covers test resource requirements for data collection and ADP support. Any requirements for equipment, personnel, facilities, or ADP must be included in the OTP in order to insure proper resourcing.

5-10. Preparation

a. The format for the DTP is shown in figure 5-1. The DTP is to include only that material changed or developed for the test since the preparation of the approved TEP. Exceptions are for paragraphs 1 through 6 of the DTP format which repeat material contained in chapter 1 of the TEP. This material is necessary to establish for the reader/user basic requirements for the test and general descriptions of the system to be tested.

(INSERT FIGURE 5-1)

b. Paragraphs and appendixes of the approved TEP which have been modified or further developed as well as planning material developed subsequent to approval of the TEP should be included in the DTP. Any change to the approved TEP supported by a formal TCP in accordance with chapter 3 should be included and the approved TCP included in appendix S to the DTP. Changes to chapters 1 through 3 of the TEP should normally be supported by a TCP if the change addresses issues and criteria or OTMOP, overall OTE methodology, required test events or sample sizes, specified statistical confidence levels, or other major test design, execution, or evaluation requirements.

c. Paragraph 7 of the DTP provides the method for documentation of changes to chapters 1 through 3 of the TEP. Changes can be documented as subparagraphs of paragraph 7 (as shown in the example) or as an appendix with entries similar as those shown for paragraph 7 or as copies of changed pages with the changed portions underlined or shown in bold type.

d. Paragraph 8 and the appendix list for the DTP provide the method for documentation of changes to the appendixes of the TEP. Brief descriptions of the extent of change or development to each appendix should be contained in paragraph 8. A complete copy of the changed appendix with the same appendix letter as for the approved TEP will be attached to the DTP. Those appendixes not changed from the TEP will be identified as not changed as indicated in the format example. Additional appendixes will be lettered as appropriate following the last letter used.

e. The intent of the format just described is to simplify the development of the DTP by eliminating unnecessary redundancy. However, the tester should be aware that test planning is evolutionary in nature. The TEP may embody the concept of the test but, for a variety of reasons, that concept may not fully mature until shortly before the test starts. And, as the DTP must serve as the very blueprint of how that test is to be executed, the level of specificity expected of it often exceeds that of the TEP. Therefore, a rigorous review of the TEP must be conducted in all planning areas to ensure that needed guidance is available. Should that review indicate a shortcoming, further development of requirements should be performed and included in the DTP as described.

5-11. Review Process for the DTP

a. Internal review. Upon completion of the DTP, it should be reviewed, coordinated, and usually briefed within the test directorate responsible for planning and conducting the test. Since practices vary among test directorates, the test officer should determine well in advance the procedures he must follow for internal review.

b. External review. External coordination or review of the DTP is not required unless specified by the TEP approval document; however, it is recommended that this document be coordinated with the test proponent, operational evaluator, and TIWG members if time permits.

5-12. Distribution

The test activity will retain two copies of the DTP for record purposes. Sufficient copies will be available in the test directorate for use by test personnel.

5-13. Appendixes to the DTP
The appendixes provide required copies of pertinent supporting documentation, provide administrative listings, and expand TEP paragraphs and conceptual appendices into detailed plans for execution.

5-14. Content of the appendixes

a. Supporting Documentation. This provides a listing of pertinent system documentation to include the MNS, ORD, TEMP, OTP, the test support packages, the TEA and the EIS. Each document will be listed by title, responsible activity, status (e.g. approved, draft, under revision), and dates of approval or date of draft. Do not attach copies of these documents to the DTP.

b. Background. This optional appendix is included only if it appears in the TEP.

c. System Description. This optional appendix is included only if it appears in the TEP.

d. Projected threat. This optional appendix is included only if it appears in the TEP.

e. DAG Charter and SOP. A copy of the DAG Charter and SOP is included by the evaluator if requirements for a DAG are specified in chapter 2 of the TEP. Details for the preparation of a DAG charter and SOP are contained in Section IV. For abbreviated evaluations and for tests of combat/training developments, the tester may charter a DAG and add this appendix.
When the need for a DAG is identified by either the tester or the evaluator, its mission and responsibilities are defined in this appendix.

f. OTP. A copy of the most recent and approved OTP referenced in appendix A is included as appendix F by the tester. Where appropriate, a test resume sheet (TRS) may be substituted for the OTP.

g. POA. The POA should not change from the TEP.

h. Test scenario(s). This optional appendix is included only if it appears in the TEP.

i. Test threat. This optional appendix is included only if it appears in the TEP.

j. Control Plan. See Section V.

k. Data Management Plan. See Section VI.

l. ITTS Support Plan. See Section VII.

m. Audiovisual Support Plan. See Section VIII.

n. Automation Support Plan. See Section IX.

o. Training Plan. See Section X.

p. Test Support Plan. See Section XI.

q. Test Environmental Assessment (TEA). A copy of the approved TEA is included by the tester.

r. Environmental Impact Statement (EIS). A copy of the approved EIS is included by the tester.

s. DOTE Approval of the Test Concept. Carried forward from the TEP.

t. Test Change Proposals (TCP). Carried forward from the TEP. (See Chapter 3.)

u. Glossary, Acronyms, and Abbreviations. See Chapter 3.

v. TEP Coordination Record. See Chapter 3.

w. Authors and Supporting Personnel. See Chapter 3.

x. Distribution. See Chapter 3.

Section IV
DAG Charter and SOP

5-15. Establishment of the DAG
The IOE establishes the requirements for a DAG on full-evaluate system tests. These requirements are documented in the TEP. If the IOE does not require a DAG, the tester determine if a need exists and establishes a DAG. The tester determines if a need exists and establishes a DAG for an abbreviated evaluate systems and for FDTE, CEP, and CT.

5-16. DAG Charter and SOP
The originator of the requirement for the DAG prepares the DAG charter and SOP in Appendix E of the TEP (e.g., when the IOE requires a DAG for full-evaluate system tests, the IOE prepares Appendix E). The format for the DAG SOP is provided in figure 5-2. The DAG SOP states the purpose, responsibilities, and the products of DAG for a specific test.

(INSERT FIGURE 5-2)

Section V
Test Control Planning

5-17. Test control defined
The structure and procedures that will be used to ensure that required test events occur in situations that realistically depict the tactical context of the test in accordance with the OMS/MP, the CBTDEV prescribed test scenarios, and the approved threat for test.

5-18. Determining requirements for test control
The concept for test control is jointly prepared by the chief controller analyst and the test officer and describes the structure and procedures for control of the test. It permits quick identification and provides for resolution of requirement misinterpretation prior to test. If identified requirements cannot be met, the issues are raised to appropriate levels for resolution.

5-19. Documentation of test control planning
This section provides guidance for incorporation of test control planning for OTE. This planning results in development of the Test Control paragraph in the TEP, the Control Concept Appendix to the TEP, and the Control Plan Appendix to the DTP. This section applies to all OT. Tests of major systems, with extremely large test matrices and numerous test events, may require most of the elements in the plan. Tests which are less complex may not require all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-20. Test Control Planning Process
Planning must provide necessary Test Control to OTE conduct. This section describes the procedures, documents, and functions that must be developed to ensure that the test can be properly organized, controlled, and executed to generate the required test data. The section describes plans in detail but allows

flexibility for the tester to tailor the plan for his specific test.

5-21. TEP control support concept
This optional appendix to the TEP contains details of planned test control not contained in the main body of the document. It is expanded into the Control Plan in the DTP. The concept has no fixed format, but using the order of presentation given for the Control Plan provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-22. Documentation of the Control Plan
Planning for test control is an iterative process which begins with general control measures and evolves into a specific design for control.

a. The central document for test control planning is the Control Plan. It is prepared by the test officer assisted by the Chief Controller.

b. Detailed instructions for development of an ASP are provided in figure 5-3.

(INSERT FIGURE 5-3)

5-23. Test Control Concept
This section of the plan describes the control concept. This paragraph includes descriptions of the control structure and procedures that will be used to ensure that required test events occur in situations that realistically depict the tactical context of the test in accordance with the OMS/MP.

5-24. Level of Operational Realism
The choice among the three levels of operational realism should be stated along with a short rationale for the choice. These levels are (see Chapter 3 for definitions):

a. Maximum Operational Realism.

b. Limited Operational Realism.

c. Minimal Operational Realism.

5-25. Synopsis of Events
An overview of the proposed test events and the environment and sequence in which they will occur. For maximum operational realism, a narrative of the major tactical operations and their sequence is valuable in assessing realism. For tests involving

limited operational realism, the tasks or missions to be performed are to be described.

5-26. Control Methods
An overview of the methods to be employed in causing the test events to happen.

5-27. Program of Events
This section provides both an outline of what should occur during the test and a detailed time schedule of explicit events.

5-28. Overall Test Scenario

a. This outline divides the test into days, mission profiles, events, subtests, phases, or any other convenient divisions. A day or a mission may be repeated a number of times to develop sufficient data as required by the event matrices. Any such repetition should be scheduled to agree with ordering constraints or randomization requirements in the matrix.

b. This outline reserves periods within which events occur and serves as a tool for coordination. General procedures are developed to address delays or other events which preclude accumulation of scheduled data due to weather, instrumentation failures, system failures, or other such events.

5-29. Detailed Test Scenario

a. The detailed test scenario consists of a time schedule of events, a description of events, and associated documents for event inputs. Based on the overall test scenario, realistic operational events are scheduled into appropriate time blocks using enemy threat documentation, U.S. doctrine and tactics, and test constraints.

b. For test scenario purposes, an event is something that can be controlled and scheduled to occur at a specified time. For example, the initial conditions (time, location, tactics, force sizes) for an opposing force ambush of a friendly infantry platoon can be specified in advance, so such an ambush can, therefore, be considered an event. However, the resultant actions following the ambush are generally unpredictable, so they would be regarded as test outcomes rather than test events.

c. Appropriate documents used to support or initiate test scenario events may be operations orders, intelligence reports, fragmentary plans, and simulated enemy documents. The completed detailed scenario is the principal control mechanism for the test.

d. A major function of the pilot test is to examine the adequacy of this mechanism and identify changes necessary for the actual test. Procedures are developed to monitor scenario execution during the actual test to verify that programmed events are executed in accordance with the detailed scenario. The organization and level of detail of the program of events depend upon the level of simulated realism required.

5-30. Full Tactical Simulation.

a. For tests which require simulation of a tactical environment for extended periods, the program of events will consist of a complete scenario. Essentially, a scenario is a narrative which merges the test events into a realistic and believable sequence. A scenario describes the actions of all player and OPFOR units and includes all information which will be presented to the players. This information includes initial and update situation briefings, operations orders, fragmentary orders, intelligence summaries, messages, and other information designed to evoke player response.

b. Particular attention must be paid to the actions of OPFOR. Their operations should in all cases be consistent with the tactics of the threat force being considered.

c. All scenarios must be based on one of the TRADOC standard scenarios. The particular standard scenario to be used is agreed upon by the test organization and the proponent, usually during the OTP preparation or the preliminary test planning phase. In preparing the scenario, it is essential to specify the time and location of each planned event.

5-31. Limited Tactical Simulation.

a. In tests which do not require maximum combat realism, the preparation of a scenario is unnecessary. It is, however, necessary to develop a detailed description of the events that will occur. The description should be sufficiently detailed so that the events can be properly executed without additional information.

b. For each event the method, time, location, participants, and information to be provided must be specified. It is often possible to group similar or near simultaneous events into subtests. This reduces the volume of necessary description and makes conduct of the test more efficient.

5-32. No Tactical Simulation

For tests such as user evaluations and some customer tests, no simulated realism is required. For such tests, the event summary can be augmented as necessary to provide a description of the conditions or situations planned or expected during the test. Examples include identification of test units, organization of the test into phases, and expected frequency of key events.

5-33. Control Procedures
The program of events describes in detail the events which must occur. The control procedures support the program of events by specifying the system which will cause the events to occur. The content of the control procedures depends upon the level of simulated realism required in the test.

5-34. Control Procedures for Full Tactical simulations
For tests of full tactical simulation, the primary control objective is to induce the test players to comply with the scenario. In support of this objective, the control procedure should describe the control organization and responsibilities, the scenario revision and documentation, and the casualty assessment requirements.

5-35. Scenario Revision and Documentation.

a. Since the scenario is a very detailed document, it is to be expected that changes may become necessary during the test. Major changes may require proponent concurrence. When information from field controllers indicates that a change has occurred or will occur, the control headquarters should be prepared to revise the scenario in order to ensure the occurrence of required events.

b. This section of the control procedure should contain guidelines for revising the scenario and should direct procedures for documenting the revisions. The best procedures for documenting a revision is to keep a log within the control headquarters. This log should list all test events, by time and location, as well as directed revisions. This log then becomes a revised scenario.

5-36. Casualty Assessment.
An essential element of full tactical simulation is the method used for assessing casualties during engagements. When instrumentation systems are used, this section should describe the vehicle and weapon simulations. Guidance on employment of instrumentation systems must be obtained from the agency or office that maintains and operates that system. If controllers assess casualties, then the procedure must be specified in detail. Guidance on assessment procedures can be found in plans

of prior tests and in FM 105-5. The assessment of casualties is of crucial importance, not only because it directly affects test data but also because it has a major effect on troop enthusiasm and morale.

5-37. Control Procedures for Limited Tactical Simulations
The control procedures for limited simulation tests is similar to that required in cases of full tactical simulation. It is usually, however, less elaborate since the control function is less complicated. Since this category covers a wide range of tests, the best guidance in planning the control procedures will be obtained from plans of similar prior tests. As a minimum the document should include the control organization and functions, a method for revising the program of events, and a system for documenting the revisions. Casualty assessment may be required for some tests of this type.

5-38. Control Procedures With No Tactical Simulation
For tests with no simulation, the control procedure consists, as a minimum, of two parts.

a. The first part describes the supervision and monitoring that the test officer or other controllers will perform to assure that the test item or concept is being employed properly. The description should include a schedule of visits or inspections and a listing of points to be checked. Such frequent checks are necessary to assure that misuse or misunderstanding does not bias results of the test.

b. The second part should outline contingency procedures to be employed if any required events do not occur in the course of the test unit's operations. These procedures will often involve some limited simulation testing. Any additional information which would enhance understanding of the conduct of the test should be included.

5-39. Pilot Test

a. A pilot test is an abbreviated version of the actual test and is conducted in advance to detect deficiencies in the plan. For this reason it should, as a minimum, include the exercise of each type of required event and make use of each data collection, data reduction form, and mechanism to be used in the actual test.

b. The pilot test should be provided for in the control plan with sufficient time between pilot test and the start date of the actual test to allow for reaction and correction of any deficiencies encountered in control, data collection, and data

reduction. Tests relying heavily on instrumentation may require additional time after the pilot test for the correction of problems.

c. Accomplishment of an abbreviated program of events is usually sufficient, although an abbreviated control procedure may also be required.

5-40. Organization for Control
The control organization and responsibilities section will describe the structure of the control group down to individual level. The required background and qualifications for each member of the organization will be specified. The mission and responsibilities of each subunit will be described in detail.

a. No single organization is applicable to all tests. Every control organization requires a centralized headquarters to issue instructions, reallocate assets, and monitor progress.

b. In addition, field controllers are required to provide information to the headquarters and to intervene, if necessary. These field controllers may accompany the units or they may be assigned to locations in the test area. Occasionally, a combination of unit controllers and area controllers is necessary.

c. The test officer must develop the control organization plans. This plan describes the organization of the control section, including functions and responsibilities of key section personnel and plans for the briefing, debriefing, replacement, relief, and rotation of controllers. It also describes the formal control documentation required, including test status reports, historical records, and submission schedules.

d. Controllers maintain high test quality by ensuring that required test conditions are met. If the test is a product improvement to an old system, use of controllers from a unit similar to the player unit is encouraged. For a new system, controllers may come from a school, test directorate, or other unit.

e. The control section usually consists of teams with one team assigned to each kind of system or major end item. Each team requires enough personnel to allow for division and rotation of duties. Since opposing forces are usually controlled by the scenario, they are typically placed under jurisdiction of the control section.

f. The controllers are responsible for recommending a halt in testing when incidents or problems emerge which significantly limit achievement of test objectives or when a serious safety or health hazard is identified.

g. Controllers maintain a log of events or scenarios which record the conditions which existed during the test as opposed to what was planned. This log is separate from the task of the data collectors who record what resulted from the test conditions.

5-41. Communications Control

This section describes the communications systems required to control and support the test. The core of the communications plan is the development of radio and wire nets for test control, data collection, and player communication purposes. Frequency allocation is to be done early and in close coordination with appropriate local authorities to preclude unanticipated interference with military or civilian communications or test instrumentation. It is always better to have more frequencies than needed, rather then risk comprise in control or safety for lack of alternatives.

5-42. Operations Center

This plan describes standing operating procedures for the test operations center, including hours of operation and staffing levels. The test operations center facilitates minute-by-minute control of testing and requires the capability to obtain, coordinate, and communicate authoritative decisions quickly for "hold-scrub-substitute" questions, for test incidents, or emergencies. The test operations center maintains a detailed log of all test events and control decisions.

Section VI
Data Management Planning

5-43. Data Management Defined

Data management is the collection, quality control, reduction, and storage of test data generated during test execution into a more condensed and usable format for analysis and, ultimately, into test results and evaluation.

5-44. Determining Requirements for Data Management

The concept for data management is jointly prepared by the chief data collector, the data manager, the test analyst, and the test officer and describes support to be provided in order to meet the data requirements of the test. It permits quick identification and resolution of requirement misinterpretation prior to test.

If identified requirements cannot be met, the issues are raised to appropriate levels for resolution.

5-45. Documentation of Data Management Planning
This section provides guidance for incorporation of data management planning for OTE. This planning results in development of the data management section in the TEP, the Data Management Concept Appendix to the TEP, and the Data Management Plan Appendix to the DTP. This section applies to all OT. Tests of major systems, with extremely large data bases and highly instrumented data collection, may require most of the elements in the plan. Tests which are less complex may not require all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-46. Data Management Planning Process
Planning must provide necessary details of OTE data management. This section explains how support planning occurs, and discusses details of how to develop and write plans for data management. The section describes plans in detail but allows flexibility for the tester to tailor the plan for his specific test.

5-47. TEP Data Management Concept
This optional appendix to the TEP contains details on planned data management not contained in the main body of the document. It is expanded into the Data Management Plan in the DTP. The concept has no fixed format, but using the order of presentation given for the plan provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-48. Documentation of the Data Management Plan
Planning for data management is an iterative process which begins with general data requirements and evolves into a specific design for data collection, reduction, storage, and quality control. The purpose of the plan is to insure a concept which satisfies data requirements and provides bases of understanding between testers, evaluators, and the data manager concerning data management. Detailed instructions for development of a Data Management Plan are provided in figure 5-4.

(INSERT FIGURE 5-4)

5-49. Data Management Concept
This section of the plan describes the data management concept and summarizes the system. This first step provides the basis for the initial part of the plan. This concept should be written in layman's terms, and should describe the system with respect to organization, flow of data, and methods of operation that the

data collectors, data reducers, and data entry personnel are required to follow. Concept development begins the iterative process for planning, which is refined and expanded as the TEP is further refined. The concept is composed of the following subsections:

a. Organization for Data Management.

b. Data Flow and Anticipated Volume of Data

c. Methods of Operation.

5-50. Data Collection Procedures
This section describes the system and the procedures the test team will use to meet the requirements for data management.

a. Collection Methods. Each method of data collection intended for the test is identified. Under each method is listed the general categories of data it will be used to collect. Methods to be considered include manual recording by players, manual recording by data collectors, instrumentation, questionnaires, and structured interviews.

b. Collection support. Any special requirements pertaining to data collection are identified. Examples include the following items:

(1) Overview of test organization and planned initial quality control procedures. This includes daily debriefing of manual data collectors and quality control checks of data collection forms to ensure completeness.

(2) Instrumentation requirements, to include software development if required (in coordination with the Instrumentation Support Plan).

(3) Data collectors with special qualifications.

(4) Expected security and special data handling requirements.

(5) Video and photography documentation (in coordination with the Audiovisual Support Plan).

5-51. Data Reduction Procedures
The procedures through which recorded test data is organized, reduced, verified, managed, controlled, and stored. Each data requirement and its means of collection are delineated in the body of the TEP. The tester organizes the data in terms of the collection source (RAM collection form, cockpit digital recorder,

radar tapes, etc.). The result of the data reduction process is level 3 data.

5-52. Data Entry
There are two basic formats for entering data into a data base: manual, and automatic feed. The extent to which each of these methods will be used in the data reduction of the test should be expressed in the plan.

a. Manual. Manual entry occurs when data is generated from forms and questionnaires, usually measuring RAM data or human factors data. Forms and questionnaires should be standardized and made as simple and objective as possible in order to facilitate the entry of the data into the ADP system. Furthermore, some type of quality control of the manual data should be planned to insure that only accurate data is entered into the data base, and that no typographical errors occur. This section should describe the data that will be entered by hand, exactly how it will be entered, which personnel will check it, and which personnel will enter it.

b. Automated. Data is entered by automation when it has been generated and collected by instruments which are tied directly into the ADP system, or collected and stored on some ADP medium. Here, a quality control plan should be devised to check the linkage between the instrumentation and the ADP system. For this type of entry, the plan should describe the data, the path it will take, where and how it will be controlled, and which personnel will control it.

5-53. Data Processing
This next step in the processing of data may consist of loading data into storage or into an organized, readable form. Procedures for this task should be included, if applicable.

5-54. Data Verification/Validation
The plan should specify the procedures for verifying and validating the data being loaded into the data base. This includes answers to where, when, how and by whom these tasks would be accomplished.

5-55. Data Storage
While data is being validated by the data manager, it will be stored in special temporary files which cannot be processed by the users. After validation, the data will be uploaded into the data base of the host computer for permanent storage.

5-56. Data Manipulation

In some cases the form of the data may need to be altered before it can be shipped to another data base, or be summarized and analyzed. These considerations, along with the details for accomplishing this manipulation, should be specified.

5-57. Data Presentation
Identify the concept for data display requirements including both management displays and test report displays. Management displays summarize the status of the test or test events. Test report displays present or, in special cases summarize, test data.

5-58. Data Base Design
Describe the concept for structure and content of the automated data base. If available at this time, the description of the test data base will include:

a. Identification of the required files to include labels, a short description of the type of data to be stored in each file, and an indication for each file whether it is to be automated.

b. A description of the architecture used to organize the data base. The architecture typically consists of either a network or relational design for data storage.

(1) The network approach requires specification of both the types of data as well as the one-to-many or one-to-one relationships between data. Such designs may not be appropriate for operational evaluation applications because only data previously related, by explicitly defined associations, can be processed.

(2) The relational approach organizes data into arrays of rows and columns. Only the types of data need to be specified; the potential relationships between data are implicitly represented. This approach permits the rapid generation of a new file, by combining across two or more types of data.

c. Definition of data elements in each file to include sufficient definitions to preclude misunderstanding and ambiguity (Data Element Dictionary).

5-59. Data Inputs and Outputs
This is a description of the data inputs and outputs. In a data base of any size this subparagraph should give a basic description and refer the reader to an appendix where each element is listed. It is related to and may be cross-referenced to the Data Base Dictionary. It should include the following data.

a. Data name: A generic or external name for the data element.

b. System name: The proper name used in the data base. This is the one that must be used when working with the data base.

c. Width (char): The minimum and maximum length in characters when the item is printed.

d. Format: The type of data in the element. A=alphabetic, N=numeric, AN=alphanumeric, Y=year.

e. Edit checks: Specifies the edit checks the system will perform.

f. Source: The original source of the data.

5-60. Data Base Structure
This section of the plan should finalize the organization and structure of the test data base. It should also detail the following considerations:

a. Dictionary. The structure of the dictionary may vary from test to test but should generally contain the data name, the system name, the data description, the range of the data, and the data source.

b. Sample Forms. The data base should be structured using sample collection forms to record RAM factors as well as other factors as they develop.

5-61. Data Base Management
This paragraph delineates the procedures for accessing and changing the data base. The activities or individuals who can query, manipulate, view, or modify all or part of the data base or other test results will be delineated. The authority to release all or part of the data will also be specified.

5-62. Quality Control
This paragraph outlines the procedures for independently validating test data. It defines the checks and procedures which are to be used by the tester to preclude or detect and correct errors made in data collection, data entry, or data reduction.

a. Both manual and automated checks are used to ensure that data are correctly entered and test events are accurately portrayed. Although manual checks often include extensive review of computer printouts, they should not generally involve extensive arithmetic operations. Such operations, together with

repetitive logical checks, should be automated to the maximum extent. Manual checks consist primarily of checks which cannot be easily automated (such as review of graphical displays).

b. This paragraph also identifies emerging data summaries required to identify potential inconsistencies. It outlines the concept for making required corrections in test data and how an audit trail for those corrections is to be maintained.

c. Data validation determines whether the data correctly represent the variables they characterize and whether the data collected are adequate. This paragraph specifies requirements for and techniques proposed for data validation. Data collection procedures are to be validated prior to starting the test and checked during the test to ensure that critical data are being accurately collected.

5-63. Output Reports

The plan should detail how the data will be reported. Some report considerations are:

a. Test Report. This report is the main document stating the processed results of the test.

b. Data Displays. The plan should specify how the data will be displayed, in accordance with the TEP. Data displays should be identified and demonstrated as early as possible in the process to insure capability to present data in conjunction with the evaluator's planned TER.

c. Other Preliminary Reports. The plan should discuss provisions for other preliminary reports of testing results such as DAG reports, Quality Control reports, Scoring Conference reports, and Test Incident Reports.

Section VII
ITTS Support Planning

5-64. ITTS Support Defined

ITTS are scientific or technical equipment, to include threat simulators and targets, used to measure, sense, record, transmit, process, or display data during tests, examination of materiel, training concepts or tactical doctrine.

a. Instrumentation. Electro-magnetic (e.g., electrical, electronic, laser, radar, photosensitive, etc.) and other equipment (e.g., optical, electro-optical, audio, mechanical,

automated information, etc.) used to detect, measure, record, telemeter, process, or analyze physical parameters or quantities encountered in the T&E process. Instrumentation may apply to a system under test or to a target or threat simulator.

(1) Major Instrumentation. That instrumentation which satisfies joint service requirements, serves multiple Army commands, requires a significant level of development and integration, or has a large dollar value. Major Army instrumentation acquisition is normally PM managed.

(2) Sustaining Instrumentation. That instrumentation which is not defined as major and which satisfies, within a single command, routine or recurring needs and normally has a lower acquisition cost than major instrumentation. Sustaining instrumentation is normally acquired by the requiring command.

b. Targets. Targets are normally economical, expendable devices used for tracking and engagement by missiles or munitions in support of T&E as well as training missions. Drone targets are air or ground vehicles converted to remote or programmable control. Ground targets are intended to represent an adversary ground vehicle system or ground based military structure. Aerial targets are intended to represent adversary aircraft. Targets may represent only selected adversary system characteristics.

c. Threat Simulator. Threat simulator is a generic term used to describe equipment which represents adversary systems. A threat simulator has one or more characteristics which, when detected by human senses or man-made sensors, provide the appearance of an actual adversary system with a prescribed degree of fidelity. Threat simulators are not normally expendable.

5-65. Need for ITTS Support

Each OTE iteration requires an ITTS Support Plan (ISP) which results in adequate, effective, and timely ITTS support for testing. The collection of test data through the use of automated instrumentation systems is a key factor in the majority of tests conducted. In addition, instrumentation systems, to include models and simulations, are often employed to provide realistic simulation of combat environments (weapons simulator, NBC simulants, etc.) and to generate data for systems to use in lieu of having actual forces in the field (combat simulations or stimulation models).

5-66. Determining Requirements for ITTS Support

The concept for ITTS support is jointly prepared by the threat analyst, the instrumentation engineer and the test officer and describes the support to be provided in order to meet the ITTS

requirements of the test. It permits quick identification and resolution of requirement misinterpretation prior to test. If identified requirements cannot be met, the issues are raised to appropriate levels for resolution.

5-67. Documentation of ITTS Support Planning
This section provides guidance for incorporation of ITTS support planning for OTE. This planning results in development of the ITTS support paragraphs in the TEP, the ITTS Support Concept Appendix to the TEP, and the ITTS Support Plan Appendix to the DTP. This section applies to all OT. Tests of major systems, with extremely large data bases and highly instrumented data collection, may require most of the elements in the plan. Tests which are less complex may not require all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-68. ITTS Support Planning Process
Planning must provide necessary ITTS support to OTE data management requirements. This section explains how support planning occurs, and discusses details of how to develop and write support plans for ITTS support. The section describes plans in detail but allows flexibility for the tester to tailor the plan for his specific test.

5-69. TEP Automation Support Concept
This optional appendix to the TEP contains details of planned ITTS support not contained in the main body of the document. It is expanded into the ISP in the DTP. The concept has no fixed format, but using the order of presentation given for the ISP Plan provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-70. ITTS Scheduling
Development of an implementation schedule is paramount to an ISP plan. This schedule must be in consonance with the overall test schedule to allow adequate planning and development time for support of the test. The support plan is the responsibility of the tester with input from the evaluator. The tester, in turn, assigns a threat analyst and an instrumentation engineer with the requisite technical expertise to help prepare the plan.

5-71. Preparation of the ISP

a. When ITTS support is required for test scenarios and data collection, the requirements are prepared by the tester and supporting threat and instrumentation elements. They describe the support to be provided in order to meet the ITTS requirements

of the test. Advance planning permits quick identification and resolution of requirements misinterpretation prior to the test.

b. The support needed is based on automation requirements and threat portrayal developed during overall test planning. ITTS planning is conducted to identify those ITTS systems that are required to collect data to address the test issues and provide the necessary degree of combat environment realism or generation of cue/task loading information.

c. The test officers must identify, through the overall data requirements identification, test control procedures and data collection reduction planning, the detailed requirements for ITTS support. Many sources exist to assist the test officer in identification of available systems and system capabilities.

d. Test officers should coordinate with the instrumenters as early in the test planning phase as possible for identification of requirements. Instrumentation engineers will assist the test officer in the development of all instrumentation requirements for the test. Details of each ITTS system to be used in the test must be addressed. The system description includes information on:

(1) Instrumentation source and disposition.

(2) Number and qualifications of operators and maintainers required for each shift.

(3) Appropriate points of contact; schedules of critical acquisition or disposition events.

(4) Test site support requirements (including space, power or fuel, prime movers, and operating environment).

(5) Specialized operator training requirements.

(6) Performance specifications, including restraints or limitations, coverage capability, data accuracy, format, and unusual data reduction considerations.

(7) Function for which each instrumentation system will be employed.

(8) Data requirements being met.

(9) Concept of employment.

(10) Pretest check out criteria and procedures.

e. The ITTS support plan describes the function for which each instrumentation system will be employed, the data requirements being met, and the concept of employment. It also provides pretest check out criteria, procedures and employment schedules for each instrumentation system.

f. Planning for instrumentation support for an operational test is the responsibility of the operational tester. He appoints a Chief of Instrumentation to deal with specific requirements. The Chief of Instrumentation is part of the test directorate and, as such, reports to the Test Director. His responsibilities include the following:

(1) Responsible for operations, maintenance, collection, and control of all test instrumentation.

(2) Coordinate with the Chief of Data Management to insure smooth flow of instrumented data to and through the data management process.

(3) Serve as a member of the DAG to provide instrumentation expertise.

5-72. Documentation of the ISP
Planning for ITTS support is an iterative process which begins with general ITTS needs and evolves into a specific ITTS design.

a. The central document for ITTS planning is the ISP. It is prepared by the ITTS threat analyst and instrumentation engineer. They are usually primary members of the task force planning the test and evaluation.

b. The purpose of the ISP is to insure a concept which satisfies test scenarios and data requirements and provides bases of understanding between testers, evaluators, and the ITTS personnel concerning test support. It provides information on performance requirements, preliminary design, and impacts of ITTS systems.

c. The ISP ensures a smooth transition from the ITTS developers to the ITTS users. Detailed instructions for development of an ISP are provided in figure 5-5.

(INSERT FIGURE 5-5)

d. This ITTS planning must begin early in the test planning cycle to insure timely, adequate instrumented data during test. The process is iterative, beginning with general requirements for

ITTS, then, evolving into specific ITTS requirements and ITTS purchase or design recommendations.

5-73. Instrumentation Support Concept
This section of the ISP describes the ITTS concept and is composed of the subsections below.

5-74. Purpose
This subsection describes the purpose which is to provide the basis for ITTS development, procurement, installation and testing. This plan provides structure and guidance for collecting large and detailed amounts of test data, through more extensive and precise ITTS.

5-75. Scope
This subsection describes the scope and should introduce topics to be discussed later in detail such as equipment, training, data collection, scheduling, and number and placement of ITTS.

5-76. Approach
This subsection describes the overall approach for ITTS support to include stating data requirements, specifying types and numbers of instruments, and setting up data collection schedules. Most importantly, the approach should address the concept of balancing the realism of a test with the importance of data collection since maximum collection of data content could be made at the expense of operational realism of a test.

5-77. Brief System Description
This subsection should include a concise description of the system undergoing the test, its components, and its mission, as well as any special requirements it may create for testing. Additionally, modifications or interfaces of ITTS to the system under test need to be defined. This description should also include any impact or effect of these interfaces on the tested system's operation.

5-78. Instrumented Data Collection
Reliable operational testing, requiring the utmost realism, may conflict with collection of data. So, there must be a compromise which maximizes the combined issues of realistic testing and thorough data collection. Increasing the efficiency as well as the accuracy of data collection while minimizing the interference with player operations is the major goal of instrumentation.

5-79. Instrumentation Data Requirements
The ISP specifies data requirements as described in the TEP. This will include special considerations for some systems. Using this information, the Plan will describe the types of

instrumentation necessary to facilitate the collection of the data.

5-80. Collection Considerations
In planning the collection process a number of special considerations for instrumentation must be addressed. The considerations, of course, will vary from system to system since each system has unique problems and characteristics.

5-81. Goal
A goal for collection of instrumented data should be specified in this section. This goal should be determined with due consideration given to instrument failures, transmission errors, or other such unusual conditions that may develop. A realistic percentage of total data generated must be developed to insure proper analysis can take place. As a minimum, critical items must be identified for collection, to include a minimum quantity of each. In some cases the test event may be a non-repeatable, singular event, in which case it becomes a critical item to collect, therefore redundant collection methods or systems should be planned. In other cases, the evaluator, analyst, tester, and instrumenter must insure enough data is collected to have the proper sample size for conduct of the designated analytical procedure. This percentage should be determined well in advance of the test, identified with a value, and be considered in both instrumentation planning and test event scheduling.

5-82. Redundancy
Depending on the particular system and test, there may be a requirement for redundant collection. Redundant instrumentation involves more than one instrument or more than one type of instrument collecting the same data at the same time. This might involve setting up dual sensors, for instance, if the characteristics of the system make many cycles of testing infeasible. This redundancy lowers the probability of missing pertinent data due to instrument or personnel malfunction. Redundancy must be balanced against cost and occurrence. That is, if an event in an operational test calls for a singular, destructive event (e.g., destroying a vehicle), the redundancy should be extremely high.

5-83. Movement
The ISP addresses specific considerations of instrumentation movement. If and when instrumentation cannot be moved without major support requirements, that fact must be considered in planning events and in coordination with the test planner. This section should answer questions such as:

a. Does the operational test require instrumentation to move?

b. How much mechanical, chemical or electrical stress on instrumentation will the test create?

c. How much stress can the instrument sustain without malfunctioning?

d. Will the movement reduce the instrument's accuracy to any extent? Can some of this movement be avoided?

e. How long will the movement last?

f. Should data collectors follow the movement?

g. Is the instrument the most viable candidate for data collection desired considering the movement involved in the test?

h. Will the instrumentation need to be ruggedized, and, therefore, how much additional lead time will be required?

5-84. Additional Equipment.
The ISP should also discuss the issue of whether additional support equipment will be necessary to make the instrumentation operable. This could include separate transportation required for some instrumentation. As a minimum, the plan should include a list of all additional equipment required with explanations of planned use and a list of the corresponding instrumentation with which the equipment will be used. The cost of instrumentation must include cost of the additional support requirements when determining cost trade-offs with manual data collection.

5-85. Interface with ADP
The ISP requires close and continuous coordination with the Data Management Plan and the ASP to insure compatibility. This section includes plans to provide appropriate interfaces between the instrumentation system(s) and the ADP system(s) which will aid in the streamlined transfer of data from the instrumentation equipment to the ADP files or data bases. These procedures should specify the techniques, protocols, and formats for accomplishing the transfer of data and plans for verifying that complete transfer has occurred.

5-86. ITTS Requirements
The ISP will detail requirements for a particular system by addressing the following issues:

a. Number and Type of Evaluated Systems. The test designer decides the number of evaluated systems to be instrumented in the test. He makes his decision respecting feasibility, cost, and risk. All the aspects of threat portrayal, data requirements, accuracy, and tolerances must be considered. Normally, all systems under test, including baseline systems, are instrumented but do not necessarily require target or threat simulator systems on a one-to-one basis.

b. Data Inputs. This section of the plan describes data input points, such as, type and location. It also details how data inputs will be recorded and details any security requirements necessary for the data (e.g., encryption). This section should include any other special considerations of data inputs unique to a particular system which may require instrumentation. For instance, the ARSIS instrumentation on the Howitzer Improvement Program (HIP) must tap into the HIP's own data bus for some pieces of data.

c. Mobility. This section describes and details the mobility requirements and considerations for the ITTS. Though test procedures for mobility are implied in the description of the system operation, these mobility factors should be discussed thoroughly here. Concepts such as travel time, type of travel, extent of travel, operability during travel, and continuity of operations should be considered for instrumentation. In some cases instrumentation may be attached to a system under test, but in other cases it may need prepositioning. If prepositioned, then mobility and the capability to move from one site to another become major considerations in allocation of ITTS resources.

d. Scenarios. The various scenarios of the operational tests should be described in relation to the ITTS which is needed. The scenario should include the extent of intelligence on the enemy, all staging and props needed to set up the circumstances for testing the system in a realistic environment (e.g., nuclear, biological, or chemical), and the test requirements accompanying that environment. Threat simulators, especially in the area of electromagnetic propagation, have a major scenario impact upon ITTS support. Scenarios should provide details on the presentation of targets to detection, target acquisition, and firing systems.

e. Security. A security plan for the ITTS must be developed to insure adequate physical security and communication security, if required. If collected data is classified, TEMPEST or other security methods are to be followed. DOD range security requires that all radio frequency data signals be protected. Storage,

transfer, and accountability procedures for equipment must be described in detail.

f. Power Sources. Power sources for ITTS should be determined and provided if not readily available. Power failures as well as power surges must be anticipated. Care should be taken to insure that the equipment voltage capacity and available voltages match, or that transformers are available. If non-standard power requirements are necessary, incorporation of these requirements into the OTP is critical. Requirements for redundancy of power sources should also be specified.

g. Collection Locations. This section specifies the locations of data collection points and insertion point for targets and threat simulators. It should include a brief description of type and extent of data to be collected or insertions to be made at each point.

(1) Clear instructions should be provided for each collection point to insure that each point is manned as necessary and is in the proper location. A communication plan should be developed which would allow for readiness checks at each point of collection.

(2) Of course, some points will be located on the system being tested, and some will be stationary.

(a) The advantages of instrumentation being attached to the system under test are that the collection process is made more flexible, and the tests are usually more realistic. The primary disadvantages, however, are the interaction and probable impact of instrumentation on the normal operation of the system. Another disadvantage is that attached instrumentation takes great stress and strain, and therefore accuracy might be lost. Furthermore, attached instrumentation cannot be as elaborate, and requires more support planning for computer linkages and other logistical problems.

(b) The advantages of stationary instrumentation correspond to the disadvantages of mobile instrumentation. For instance, stationary instrumentation can be more elaborate, and have high performance sensors; however, in using this stationary instrumentation, location or other constraints may be placed on testing, therefore losing realism in the test.

h. Soldier Monitoring. Soldiers representing typical user troops (players) will be monitored during some tests. Details of this monitoring effort need to be stated clearly in the ISP, as well as referenced in the Data Management Plan. The ISP should

detail how, if applicable, personnel are instrumentally monitored, in what phases, and the effect. For example, video footage of a process may be appropriate in some cases, while in others monitoring of some specific bodily function (e.g., heart rate) may be appropriate. Instrumentation for system operator actions which measure timeliness, efficiency, and effectiveness should also be described here.

i. Candidate Systems. This subparagraph should list all potential ITTS systems for OT of an acquisition system and should contain a brief description including its potential specific use. It should include a priority list of the best ways to acquire these systems, e.g., use of existing Government-owned systems, lease of commercial items, purchase of commercial items, and fabrication of items.

(1) This information must be developed early in the ISP draft development so negotiations for purchase or development planning or paperwork may be initiated early.

(2) The list of candidate systems should include a statement of feasibility. A particular system may be the best, most desirable instrumentation system for some data collection, but might be too expensive to buy or lease, or it might require too many personnel to operate relative to the importance of the data it would collect.

(3) In the final analysis, the efficiency and cost of instrumentation must be compared to efficiency and cost of a manual data collection. As the ISP becomes finalized, the selected instrumentation system becomes an integral part of the plan.

5-87. Other Support Requirements
Addressed in this section are other requirements supporting ITTS which have not been previously mentioned in the plan. These include requirements for storage and handling of ITTS; for transportation of ITTS to and from the test site (e.g., special secure transportation required); for support personnel to transport, handle, maintain and store ITTS; for special facilities to house and operate ITTS; for support communications necessary for ITTS; and for special tools or service necessary for ITTS.

5-88. Test Support
This section describes methods for implementing the ITTS planning during the phases leading up to an operational test. As a minimum it should include milestones, demonstrations, training, pilot test, and OTRR.

5-89. Milestones
The ISP test support section should state specific milestones for ITTS (e.g., target date to investigate types of equipment, target date to acquire equipment, target date to install equipment, and target date to train personnel to use equipment).

5-90. Demonstrations
Demonstrations of ITTS should be conducted within the framework of the larger Test Planning Milestone Schedule. The target dates, extent, and number of demonstrations will vary from system to system; however, some general guidelines are helpful. A demonstration should probably precede each OTRR. Also, if a new piece of ITTS is introduced to the test planning relatively late in the pre-test schedule, and after all other ITTS has been demonstrated, it should not be overlooked. A date should be set to demonstrate this new piece. Finally, a request by one of the users (e.g., data manager, test director, evaluator) to see some piece of ITTS demonstrated again should be granted if at all feasible. In other words, demonstrations should be performed at planned dates as well as any additional ones deemed necessary during pretest process. In early test planning stages ITTS may be demonstrated by itself; however, at some time before the Pilot Test, the ITTS must be demonstrated on the tested system.

5-91. Training
Specific dates should be scheduled for training personnel in the operations of ITTS. The amount of training will vary according to the complexity and amount of ITTS, but most of the training sessions should take place before the last demonstration and last OTRR.

5-92. Pilot Test
By the date of the Pilot Test as scheduled in the Detailed Test Plan, ITTS should be in full operation with fully trained personnel. For the Pilot Test the ITTS should be in place, operated as if running the actual test, and should generate real data for examination.

5-93. OTRR
Each OTRR should include a review of ITTS progress to date.

a. At the first OTRR, 270 days before the test, the review of ITTS will be preliminary and general. The tentative schedule for ITTS milestones should be reviewed. It might also suggest types and extent of ITTS anticipated. If ITTS is being built, a status report of development progress must be made near the time of the first OTRR, to insure that the equipment will be ready in time for test.

b. At the second OTRR, 60 to 90 days before the test, the review of ITTS should update the ITTS schedule and should detail the ITTS concept. By no later than the second OTRR, the ISP should also cover whether some previously planned ITTS is now deemed unnecessary and whether some ITTS needs to be added. Also, any noticeable problems with any particular ITTS should be addressed. As a result of the review, a decision is made whether to begin training personnel.

c. At the third OTRR, just after the Pilot Test, review ITTS one final time and from data collected during the Pilot Test, uncover any previously hidden problems or deficiencies remaining in ITTS. The review should also make an assessment of whether personnel are completely trained and are aware of contingency plans. This should also include a discussion of how well each ITTS system works in conjunction with the other instruments and interfaces with ITTS systems, and if there is a problem with cohesiveness, what solutions should be explored. Base this discussion on the last two or three ITTS demonstrations as well as on the Pilot Test.

5-94. Conduct of Test

During the actual conduct of the test the major emphasis for ITTS is on properly executing the plan and on insuring the data collected through ITTS flows smoothly into the data management system. The coordination of ITTS is accomplished within the test directorate under the ultimate control of the Test Director. The chief of the ITTS organizational element is an integral member of the test directorate working for the Deputy Test Director for OT and in close coordination with the chief of data management and the chief of the ITTS support. This requires the primary chief of ITTS to be present at the test site whenever instrumented data is critical to the overall data collection procedure.

5-95. Special ITTS Considerations

Some complex ITTS involve software which must be developed. This software usually requires long lead time for development, it is costly, and it must be validated well before the commencement of testing to insure data elements are collected as required and extraneous data is not added. The ISP should address these considerations, and should alert test planners to the long lead time and costly development.

Section VIII
Audiovisual (AV) Support Planning

5-96. AV Support Defined

Audio and visual documentary coverage of how operational testing was conducted, as well as collection of selected data elements for incorporation into the report. The AV documentation covers the testing and other tester activities to include test unit, test directorate, side tests/demonstrations, instrumentation, data collection, data processing, and reports/briefings.

5-97. Need for AV Support
Each OTE iteration requires an AV Support Plan (AVSP) which results in adequate, effective, and timely AV support for testing to include data collection, reduction, analysis, and reporting. The purpose of AV support is twofold. First, AV serves as a documentary of how testing was conducted, what the test sites looked like, how effective data collectors were, etc. AV is also used to collect actual test data as an input and integral part of the report. Using AV in this manner is particularly useful in the realm of human factors analysis.

5-98. Determining Requirements for AV Support
The concept for AV support is jointly prepared by the AV support personnel and the test officer in coordination with the evaluator and describes the support to be provided in order to meet the AV requirements of the test and the evaluation. It permits quick identification and resolution of requirement misinterpretation prior to test. If identified requirements cannot be met, the issues are raised to appropriate levels for resolution. The operational tester determines the extent of documentary AV necessary and the AV test data desired. He develops specific AV plans accordingly. General requirements for these two types of AV support should evolve through the test planning cycle into specific requirements, and be recorded in the AVSP.

5-99. Documentation of AV Support Planning
This section provides guidance for incorporation of AV support planning for OTE. This planning results in development of the AV support paragraph in the TEP, the AV Support Concept Appendix to the TEP, and the AV Support Plan Appendix to the DTP. This section applies to all OT. Tests of major systems, with large data bases and highly instrumented data collection, may require most of the elements in the plan. Tests which are less complex may not require all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-100. AV Support Planning Process
Planning must provide necessary AV support to OTE data management requirements and provide narrative description of test reports and briefings. This section explains how support planning occurs, and discusses details of how to develop and write support

plans for AV support. The section describes plans in detail but allows flexibility for the tester to tailor the plan for his specific test. The test planner describes the plan to support the test using videotape, still photography, or other audiovisual means. The plan proposes interim reports, schedules field coverage, and sets deadlines for each phase of the preparation and approval of a final videotape.

5-101. TEP AV Support Concept
This optional appendix to the TEP contains details of planned AV support not contained in the main body of the document. It is expanded into the AVSP in the DTP. The concept has no fixed format, but using the order of presentation given for the AVSP Plan provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-102. AV Scheduling
Development of an implementation schedule is paramount to an AVSP. This schedule must be in consonance with the overall test schedule to allow adequate planning and development time for support of the test. The support plan is the responsibility of the tester with input from the evaluator. The tester, in turn, assigns a AV specialist with requisite technical expertise to help prepare the plan.

5-103. Preparation of the AVSP
When AV support is required for data collection and test documentation, the requirements are prepared by the tester and supporting AV element. They describe the support to be provided in order to meet the AV requirements of the OT. Advance planning permits quick identification and resolution of any requirements misinterpretation prior to the test. The support needed is based on AV requirements developed during overall test planning. The AVSP is the plan to support the test using videotape, still photography, or other audiovisual means. It proposes interim reports, schedules field coverage, and sets deadlines for each phase of the preparation and approval of a final videotape.

a. In general, color videotape and color negative still photographic coverage are to be collected for all significant test events, beginning with training and continuing until completion of the final phase.

b. Enough AV material is to be collected to support a narrative description of test issues and purpose, each type test event, the conditions under which the test was conducted, and how data were collected and stored. In addition to the general test documentation, coverage of test-specific subject areas (such as

mobility, detectability, engagement sequences, and MOPP 4 trials) is suggested.

c. For each such subject area, the number and type of shots are described - "video and still shots will be taken of the test system being rigged for LAPES delivery, followed by shots of delivery and any damage sustained." Planned shooting schedules are generally provided in terms of days or weeks, on site, and with points of contact for additional intermittent support.

5-104. Documentation of the AVSP
Planning for AV support is an iterative process which begins with general AV needs and evolves into a specific AV design.

a. The central document for AV planning is the AVSP. It is prepared by the tester.

b. The purpose of the AVSP is to insure a concept which satisfies data and documentation requirements and provides bases of understanding between testers, evaluators, and the AV personnel concerning AV test support.

c. The AVSP ensures a smooth transition from the tester to AV operators. The writer of the AVSP should clearly distinguish requirements for each type of AV requirement in the plan. Detailed instructions for development of an AVSP are provided in figure 5-6.

(INSERT FIGURE 5-6)

5-105. AV Concept in the AVSP
This section of the AVSP describes the AV concept and is composed of the subsections detailed below.

5-106. Purpose
This subsection states the purpose which is to provide complete visual documentation of testing procedures and results. It also serves to support a narration or report on all aspects of testing from training to the final phases, to include: test objectives, testing site, test conditions, and procedures of data collection.

5-107. Scope
This subsection should describe the scope and should outline topics such as the amount of collection of visual material required throughout the testing process to portray accurately each phase of testing and all results. It involves planning specific shots, specific equipment, specific personnel.

5-108. Approach

This subsection should describe the overall approach to audiovisual planning which hinges on test schedule. The approach should contain topics such as planning shootings considering timeframes and test deadlines with general instructions as to what shots are desired, and yet allow the schedule to be flexible enough to adjust to unexpected occurrences in testing, equipment, or personnel.

5-109. Support Description
This subsection contains a summary of planned audiovisual test support, and provides direction for specific issues. This discussion should include significant events, personnel and training, and procedures.

a. Significant Events. This paragraph should list all events or issues for which audiovisual coverage is deemed necessary. Though the significant events may vary from test to test, the following provides guidelines for typically relevant events. It should list each significant event, including details of every aspect of the event.

(1) Detectability. Videotaping this specific subject gives an indication of how detectable the weapon system is in the eyes of the enemy. This involves positioning an audiovisual shooting downrange from the system at a vantage point realistically similar to the position of the enemy.

(2) Tactical Mobility. Videotape should also be made from vantage points which portray the ease and speed with which the system becomes and remains operative.

(3) Engagement Sequences. This refers to uninterrupted video footage of a complete operational sequence, from the point at which the gunner detects a target until one round of fire has been completed, for example. This sequence should be shot in its entirety from many different angles so that every action taken by the gunner and every response by the system can be recorded for study. This engagement sequence may also include set-up and tear-down processes for systems which require these actions.

(4) MANPRINT. The human factors analyst should be consulted as to what photographic footage would be appropriate to portray human factors in testing. This determination should be made concurrent with the development of human factors issues. The Automation Support Plan should include a schedule for preparing the soldiers and test site.

(5) Still Layouts. Still photos should be taken of each separate component of the system, and of the entire system.

These can be made in a studio with a plain shadowless backdrop. These photos can be for general reference and as an aid to a briefing or report.

(6) Targets. Coverage of live fire tests should be taken of all target types which the system engages, showing system rounds hitting and missing. Closeup photography should depict effects of hits on the target, damage sustained, and other lethality effects.

b. Personnel and Training. This paragraph should include details of type and number of personnel, and type and amount of training required to accomplish all audiovisual aid. This training may simply consist of practicing the various shots which will be required, and discussing with the audiovisual personnel the schedule of test events, and any test peculiarities which he may encounter. Personnel and training for audiovisual test support will differ from system to system, so the procedures for providing and training personnel must be flexible. For instance, a system requiring high redundancy or difficult test conditions would require more audiovisual training and maybe more full time, on-site personnel; whereas, a system test which is less complex or less lengthy could better adjust to fewer, less trained audiovisual personnel.

c. Procedures. This paragraph should explain the procedures that audiovisual personnel should follow for audiovisual support in testing. It should address all foreseeable problems. Some examples are: the procedures for procuring audiovisual equipment, the procedure for developing film, and the procedures for developing an audiovisual package of production quality (for presentations and briefings), complete with narration.

5-110. Operational Requirements
The AVSP should detail the requirements for AV support of the operational test. The plan should expand on the requirements to include specific instructions for carrying out the requirements.

5-111. Equipment

a. Video. In most cases, use of videotape is desired over still photography. Video coverage provides a more continuous and cohesive view of specific action. Video is paramount in the complete engagement sequence in order to assess overall effectiveness and suitability from start to finish.

b. Still. Still photos serve primarily as a supplement to the video presentation. They are most useful in specific shots of each component of the system for extensive examination and for

damaged or defective systems and components. Still photos allow for carefully planned, detailed shots, from many different angles.

5-112. Subject Areas for Support

Included in the AVSP should be a section covering specific audiovisual requirements for the two major areas of testing, operational effectiveness and operational suitability. The plan should detail AV support necessary for recording effectiveness and suitability information. Provide general guidelines, explanations, and expectations for the AV support to each subject area to include:

a. Type of support required (video or still, limited coverage or continuous coverage).

b. Quantity. Number of cameras and personnel needed to obtain required footage.

c. Location. The optimum locations of the cameras to obtain the required information.

d. Plan. Complete description of the integrated plan for the AV coverage.

5-113. Scheduling

Scheduling of audiovisual support consists of three parts which correspond to the three phases of the test: pretest, pilot test, conduct of the test. The Audiovisual Support Plan should contain audiovisual schedules for each of these three phases.

a. Pretest. The plan should specify aspects of pretesting which need to be photographed, such as: test site, equipment, terrain, and training.

b. Pilot Test. Full scale collection of footage should be made of the pilot test and procedures so that video can then be examined. This will allow for refinements in the instrumentation, the ADP equipment, and in the testing process itself before full scale testing. A schedule should be set so that the video will be prepared for a quick look presentation.

c. Conduct of Test. The AVSP should map out general scheduling of all pertinent test events, training, and procedures. It should specify times, places and extent of coverage desired, plus any special considerations. It should also specify the number of photographers for each event, type of film and type of photographic equipment (video or still). The plan should include a description of any other photographs which

may be required during conduct of the test such as maintenance incidents or MANPRINT and safety problems. However, it should be written such that it will allow flexibility for schedule changes. The video should again be prepared for a quick look. Then the plan should set a schedule for developing the video into a full presentation with narration which will be viewed by the approval authority for the Test Report.

5-114. Special Requirements and Continuous Coverage
This section of the AVSP will describe any special requirements for audiovisual support, such as, tests at night or tests under extreme cold or heat.

5-115. Non-Standard Tests
Given the peculiarities of operational testing from system to system, the Audiovisual Support Plan should describe any anticipated non-standard testing procedures to allow audiovisual personnel to be prepared for them.

5-116. Limited Resources
Audiovisual resources may be limited to some extent at particular sites. The Support Plan in this section should prepare the audiovisual personnel for these deficiencies, so that appropriate adjustments may be made to allow for full audiovisual support.

5-117. Support Requirements
This part of the plan will detail any specific instructions available, such as degree of continuous coverage. Also considered in this section are requirements for support from local audiovisual agencies, both commercial and government.

5-118. Contingencies
Contingency plans will be detailed here which provide guidance for audiovisual personnel in the event that testing does not go as originally planned. This makes the audiovisual concept well structured and more flexible. The plan may include contingencies for the following:

a. Equipment Failure. In the event of audiovisual equipment failure a contingency plan might include directions for replacement or backup equipment, alternative equipment, how and where to procure it, any special operating procedures, and lead time necessary to acquire.

b. Changing Requirements. Sometimes as testing proceeds, plans and schedules change. New tests are added, planned tests are restructured, some tests are dropped altogether, or requirements for data and audiovisual collection may change. The Audiovisual Support Plan should include a contingency plan which

will direct audiovisual support if requirements do change during the testing process. This contingency should include a guide as to which test officials should be consulted if changes occur, time necessary to adjust for changes, and specific procedures to follow in order to allow testing to go forward without losing audiovisual support.

Section IX
ADP Support Planning

5-119. ADP Support Defined
Input, storage, computing, control, and output services of test data, using electronic circuitry within a computer system to perform arithmetic and logical operations by means of internally stored or externally controlled programmed instructions

5-120. Need for ADP Support
Each OTE iteration requires an Automation Support Plan (ASP) which results in adequate, effective, and timely automation support for testing to include data collection, reduction, analysis, and reporting.

5-121. Determining Requirements for ADP Support
The concept for ADP support is jointly prepared by the computer analyst and the test officer and describes the support to be provided in order to meet the automation requirements of the test. It permits quick identification and resolution of requirement misinterpretation prior to test. If identified requirements cannot be met, the issues are raised to appropriate levels for resolution.

5-122. Documentation of ADP Support Planning
This section provides guidance for incorporation of ADP support planning for OTE. This planning results in development of the ADP support paragraph in the TEP, the Automation Support Concept Appendix to the TEP, and the Automation Support Plan Appendix to the DTP. This section applies to all OT. Tests of major systems, with extremely large data bases and highly instrumented data collection, may require most of the elements in the plan. Tests which are less complex may not require all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-123. ADP Support Planning Process
Planning must provide necessary ADP support to OTE data management requirements. This section explains how support

planning occurs, and discusses details of how to develop and write support plans for ADP support. The section describes plans in detail but allows flexibility for the tester to tailor the plan for his specific test.

5-124. TEP Automation Support Concept
This optional appendix to the TEP contains details of planned ADP support not contained in the main body of the document. It is expanded into the ASP in the DTP. The concept has no fixed format, but using the order of presentation given for the ASP Plan provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-125. ADP Scheduling
Development of an implementation schedule is paramount to an ASP plan. This schedule must be in consonance with the overall test schedule to allow adequate planning and development time for support of the test. The support plan is the responsibility of the tester with input from the evaluator. The tester, in turn, assigns an analyst with technical expertise to help prepare the plan.

5-126. Preparation of the ASP
When automation support is required for data management, the requirements are prepared by the tester and supporting management information systems (MIS) element. They describe the support to be provided in order to meet the ADP requirements of the test. Advance planning permits quick identification and resolution of requirements misinterpretation prior to the test. The support needed is based on automation requirements developed during overall test planning and may include:

a. A problem definition including identification of data types, data volume, processing requirements, performance requirements (turnaround, response times, etc.), ADP security, and reporting requirements (hard copy, online queries, etc.).

b. A summary of the automation system concept.

c. A technical description of the data flow.

d. Equipment including computers, printers, interfaces, decoders, and communications.

e. Software required (system application specific commercial packages and noncommercial programming requirements).

f. Data dictionary including element specification (size, type, etc.) and data element definition.

g. Milestones (for MIS, analysts, and other users).

h. Personnel requirements (programmers, systems analysts, data entry).

5-127. Documentation of the ASP
Planning for ADP support is an iterative process which begins with general ADP needs and evolves into a specific ADP design.

a. The central document for ADP planning is the ASP. It is prepared by the ADP systems analyst. He is usually a primary member of the task force planning the test and evaluation.

b. The purpose of the ASP is to insure a concept which satisfies data requirements and provides bases of understanding between testers, evaluators, and the ADP systems analyst concerning automated test support. It provides information on performance requirements, preliminary design, and impacts of ADP systems.

c. The ASP ensures a smooth transition from the ADP developer (programmer) to the ADP user (normally the data manager). Detailed instructions for development of an ASP are provided in figure 5-7.

(INSERT FIGURE 5-7)

5-128. ADP Support Concept
This section of the ASP describes the ADP concept. As an initial step, the ADP analyst, in coordination with the Data Manager for the test and the evaluator, develops an automation support concept which gives a summary of the system. This first step provides the basis for the initial part of the plan. This concept should be written for non-ADP personnel, and should describe the ADP system with respect to organization, flow of data, and method of operation that the system ADP analyst is required to follow in order to develop the system. The ADP concept development begins the iterative process for ADP planning, which is refined and expanded as the TEP is further refined. The concept is composed of the subsections described below.

5-129. Organization for Automation Support
This subsection should detail the organization for ADP. Organization for ADP is highly interrelated with the Data Management organization; however, the ADP analyst has the primary responsibility for automation support planning. The ADP analyst is responsible for keeping the T&E task force informed of the ADP progress. Additionally, he is responsible for development of the

required software, operation of the equipment for storing data, and maintenance and control of the data base on the system.

5-130. Data Flow and Anticipated Volume of Data
This subsection should outline the expected flow of data and provide a graphic figure showing the flow. Figure 5-8 depicts an example of the flow of generated data from its entry as either automated or manual to its output as reports and data displays. All data from operational tests will not necessarily follow all of the steps, but the main points of entry, reduction, temporary storage, validation, permanent loading into data base, and reports resulting from the data base will generally be used for an OT of any size. These steps should be addressed as well as the anticipated volume of data to be received and stored for the particular OT.

(INSERT FIGURE 5-8)

5-131. Method of Operation
This subsection should describe as completely as possible the method of operation. The ASP is written as many of the documents and events leading to a test are still in the conceptual or planning stages; so, pertinent assumptions of the method of operation that may affect the overall automation support should be included in the plan. These assumptions eventually are replaced by decisions as the concepts evolve into actual demonstrations. As a general rule, assumptions should be made for any area of uncertainty. Assumptions may be classified in two major categories: Equipment or Services and System or Software.

a. Equipment or Services. Included in this category are any ADP assumptions concerning hardware or personnel. Examples of areas that may require assumptions are: availability of computers by type and number, telecommunication lines leadtime, qualification of data entry personnel or programmers, availability of ADP personnel at test site, and security capability of equipment.

b. System or Software. Included in this category are any assumptions concerning the overall operating environment of the automated system. Examples are: type and availability of the operating system, completion and check of any new software, availability of contractor support if required, and utilization of any common data structure such as the OPTEC OTERAM system.

5-132. Design Details

This section describes the ADP system, its requirements, and the procedures the ADP will use to meet the requirements for ADP support.

5-133. ADP Functional Description
This subparagraph of the ASP should describe the ADP system's functional characteristics and operations to provide a working knowledge of the system. It should include an exact description of how the system operates, the path of the data, how the data will be stored, and how and to whom it will be available.

5-134. Detailed Characteristics
This section presents a detailed description of the performance requirements of the ADP system in non-ADP terminology, including interface with other elements of data management. Emphasis is placed upon the system being "user friendly." System failures are not unexpected in any development, and this section addresses the most likely failures and contingencies to overcome them.

5-135. Performance Requirements
Minimum performance requirements are defined and specified. Where available these tolerances are extracted from the TEP or otherwise specified by the evaluator. In some cases performance requirements that are omitted from the TEP, but common to ADP, should be emphasized in this section. The performance requirements may be subdivided into accuracy, timing, and inputs.

a. Accuracy. Every effort should be made to design into the ADP system the means to insure accuracy and veracity of the data as it flows through the system. Several levels of checks can be built into the process of raw data collection to eliminate transcription errors. Individual data point values entered into required fields can be checked. Mutually exclusive elements must coincide, and forms must agree where appropriate. This section describes where data entry checks are made to eliminate typographical errors. It should describe where to expect errors in transmission and what to do. Finally, the rounding factors for such items as times, distances, and meter readings should be explained. There should be reference to the corresponding paragraph of the TEP where appropriate.

b. Timing. The timing requirements specified in the TDP for data flow and turnaround are restated in this section of the ASP to insure proper understanding by both the ADP programmer and the tester. Response times for availability of ADP output should be specified (48 hours is a good rule of thumb). For example, "the time requirement for the period from the time an incident has completed DAG review until the validated data is accessible in a report from the data base is 48 hours." Additionally, the

response time of the system should be described here to include reasons for expected delays such as heavy use periods or complicated mathematical operations.

c. Inputs and Outputs. This is a description of the data inputs and outputs. In a data base of any size this subparagraph should give a basic description and refer the reader to an appendix where each element is listed. It is related to and may be cross-referenced to the Data Base Dictionary. It should include the following data.

(1) Data name: A generic or external name for the data element.

(2) System name: The proper name used in the data base. This is the one that must be used when working with the data base.

(3) Width (char): The minimum and maximum length in characters when the item is printed.

(4) Format: The type of data in the element. A=alphabetic, N=numeric, AN=alphanumeric, Y=year.

(5) Edit checks: Specifies the edit checks the system will perform.

(6) Source: The original source of the data.

5-136. Failure Contingencies
The ADP systems analyst would be remiss not to plan for system failures. There are two general approaches to failure contingencies: backup and fall back.

a. Backup. Ideally, every ADP system would be backed up several times, but this must be considered in light of cost, time, and risk. A significant amount of redundancy should be planned, especially in the number of microcomputers or terminals. If a host system is used, rerouting or alternative systems may be considered. Since communication failure is a common occurrence, especially in electrical storms, alternative lines should be planned. Planning for failure of personnel to perform must also be included when analyzing redundancy requirements since operators may be absent for a myriad of reasons.

b. Fall back. The more serious failure is the type for which redundancy has not or could not be planned. Several options need to be planned, especially for backing up working data on a regular basis. For most operational tests, microcomputers will

store enough on diskette to bridge a communication failure. Power failures could cause catastrophic results if not anticipated; so, procedures such as storing data by alternative means (e.g., diskette, tape) should be considered.

5-137. Data Entry
There are two basic formats for entering data into an ADP system: manual, and automatic feed. The extent to which each of these methods will be used in the data processing of the test should be expressed in the ASP.

a. Manual. Manual entry occurs when data is generated from forms and questionnaires, usually measuring RAM data or human factors data. Forms and questionnaires should be standardized and made as simple and objective as possible in order to facilitate the entry of the data into the ADP system. Furthermore, some type of quality control of the manual data should be planned to insure that only accurate data is entered into the data base, and that no typographical errors occur. This section should describe the data that will be entered by hand, exactly how it will be entered, which personnel will check it, and which personnel will enter it.

b. Automated. Data is entered by automation when it has been generated and collected by instruments which are tied directly into the ADP system, or collected and stored on some ADP medium. Here, a quality control plan should be devised to check the linkage between the instrumentation and the ADP system. For this type of entry, the plan should describe the data, the path it will take, where and how it will be controlled, and which personnel will control it.

5-138. Data Processing
This next step in the processing of data may consist of loading data into storage or into an organized, readable form. Procedures for this task should be included in the ASP, if applicable.

5-139. Data Verification/Validation
The ASP should specify the procedures for verifying and validating the data being loaded into the ADP system. This includes answers to where, when, how and by whom these tasks would be accomplished.

5-140. Quality Control
This part is an overall view of the control of the ADP system, its components, its support, and the data it processes. The ASP should contain specifics of this control.

5-141. Storage
While data is being validated by the data manager, it will be stored in special temporary files which cannot be processed by the users. After validation, the data will be uploaded into the data base of the host computer for permanent storage.

5-142. Data Manipulation
In some cases the form of the data may need to be altered before it can be shipped to another data base, or be summarized and analyzed. These considerations, along with the details for accomplishing this manipulation, should be specified in the ASP.

5-143. Output Reports
The ASP should detail how the data will be reported. Some report considerations are:

a. Test Report. This report is the main document stating the processed results of the test.

b. Data Displays. The ASP should specify how the data will be displayed, in accordance with the TEP. Data displays should be identified and demonstrated as early as possible in the process to insure capability to present data in conjunction with the evaluator's planned TER.

c. Other Preliminary Reports. The ASP should discuss provisions for other preliminary reports of testing results such as DAG reports, Quality Control reports, Scoring Conference reports, and Test Incident Reports.

5-144. Analysis Requirements
The plan should also address the requirements for analysis on the data, and how this should affect its processing.

5-145. External Interfaces
Included in the ASP should be a statement of who can access the data base and from where outside the actual testing realm (e.g., another test agency, some other test site, or members of the DAG).

5-146. Data Base Structure
This section of the ASP should finalize the organization and structure of the test data base. It should also detail the following considerations:

a. Dictionary. The structure of the dictionary may vary from test to test but should generally contain the data name, the system name, the data description, the range of the data, and the data source.

b. Sample Forms. The data base should be structured using sample collection forms to record RAM factors as well as other factors as they develop.

5-147. Output Reports

Considerations for output reports should be detailed in the plan and reflected in the data base structure.

5-148. Environment

This section of the ASP should specify the physical and environmental ADP requirements to support the test. Issues include:

a. Hardware. The ASP should list all hardware involved, computer name and type, as well as all accessory requirements such as a modem. Accessories should be checked for compatibility with the computer. The ASP should also discuss procedures for care of hardware. For instance, hardware should be housed in a temperature controlled facility with proper electrical current. Furthermore, some type of backup electricity should be planned and made accessible in the event of power failure. The ASP should also state what type and number of personnel will be required for operation.

b. Communications. Also, the ASP should list communications equipment required and a description of how the communication network will work. Both internal and external communication networks should be considered. Plans for hook-up should be made well in advance (at least eight months) of the commencement of testing. The plan should tell how many commercial lines and how many internal lines need to be installed, and the type and number of modems necessary. This, of course, will vary from test to test, but any test should have at least two or three commercial lines with long distance capability. The plan should also specify, as soon as possible, which phone company will be handling the network, hook-up, and operations.

c. Facilities. Requirements for facilities are covered in other test planning documents, but they should also be considered for compatibility with ADP equipment. These considerations include, as previously mentioned, temperature controlled rooms and backup electrical power. Furthermore, depending on the nature of the testing, there may be requirements for ADP in vans or some other mobile housing. Also, the number and placement of buildings at test headquarters may affect ADP plans.

d. Cost. A breakdown of the cost of each ADP element should be contained here. This cost should be weighed against the

complexity and detail of the test requirements to determine if some elements are not cost effective.

5-149. System Development
This section of the ASP should articulate the specific supporting role of the ADP systems analyst to the test. Topics for discussion should include:

a. Software Development. The discussion should define exactly what role the analyst plays in the development of software for ADP. It should tell to whom the analyst reports, how frequently, and how many support personnel (programmers) will be needed. The plan should provide instructions as to what equipment is available and should give a time schedule for completion of the development of the software.

b. User's Manual. The analyst should oversee the writing of the user's manual. The ASP should specify how and when the ADP analyst plans to proceed with the writing and publication of the manual. This should include completion dates for drafts and final copy. Also the plan should specify how the analyst plans to delegate portions of the writing of the manual.

c. Coordination. The analyst should coordinate all phases of the ADP system. For instance, the analyst should periodically update all personnel involved in ADP system development. The ADP analyst should coordinate all meetings and activities between programmers, manual writers, personnel who will operate the equipment, evaluators, testers, and other task force members.

d. Training. The analyst, since he will be intricately involved in the planning and development of the ADP system, should also oversee the training of personnel to operate the equipment. This will insure that smooth, cohesive and proper training occurs.

5-150. Test Support
The ASP should also contain all the ADP related milestones necessary to support the test plus a detailed description of each.

a. Milestones. In conjunction with overall OT milestones, the ASP should contain specific milestones for ADP planning. Among these are: target date for confirmation of ADP equipment list, target date for software development and user's manual, and target date for deployment of equipment.

b. Demonstrations. Imbedded in the calendar for ADP support should be planned demonstrations of ADP equipment and software.

The dates before test (T-dates) and extent of these demonstrations will vary from test to test. However, there should be no less than three. Furthermore, if new equipment or personnel enter the test process, additional demonstrations should be scheduled as necessary.

c. Training. As specified by the test directorate and the ADP systems analyst, specific dates and procedures should be detailed for training personnel to operate ADP equipment. Training will vary according to the complexity of the equipment, but training should be completed by or before the last OTRR. In the event of software or program changes, or hardware modifications, personnel may need to be trained to perform these specialized functions.

d. Pilot Test. By the date of the scheduled Pilot Test, the ADP system should be fully operational with all known deficiencies corrected. For the Pilot Test all equipment should be tested as if it were running in the actual test, and therefore should accept and process incoming data.

e. OTRR. As a part of each OTRR, there should be a section reviewing the ADP planning progress to that point. At the first OTRR, approximately 270 days before the test, a review of ADP planning should include discussion of the known requirements for the processing of data, the feasibility of the tentative schedule, and the cost feasibility of the types and extent of ADP equipment desired. The OTRR should also review the progress of communications planning. The second OTRR, 60-90 days before the test, should discuss acquisition, housing, hook-up, and training for the ADP system. It should update the tentative schedule of events, and should articulate any concerns about the system. The final OTRR, just after the Pilot Test, should review the data processing from the Pilot Test and confirm that the system is working properly, that the supporting equipment is functioning in conjunction with the other equipment, and that the personnel have been fully trained.

f. Control and Retention of Data Base. The ASP should plan for control and retention of the data base. This will discuss who has access and how to access the data base. This planning will insure that the data base is not altered or erased. To accomplish this, the plan should provide guidelines for security against tampering, and guidelines for power failure, communication breakdown or some other unexpected happening.

Section X
Planning for Test Training

5-151. Training Plan
The training concept in the TEP is expanded into a training plan in the DTP. The training plan is an essential element of the overall test planning process. Requirements for training are developed during the evolution of the control and data management plans. For each category of personnel, requirements for training are identified. A program for eliminating these shortfalls is then developed. The training plan should include designation of attendees, lesson plans, examinations, schedules, performance tests, designation of instructors, and location of instruction. Standard Army formats for these documents should be used. There is no prescribed format for a Training Plan.

5-152. Player Personnel
Training of players will provide individual, section, and unit level skills necessary to operate and maintain the equipment or perform the tactics to be tested. The results of the test will be sensitive to the amount and quality of player training. In fact, for some tests the amount and type of training received by various groups of players will be a major test variable. For all tests, the actual training received should be documented and will become a part of the final report. The tester must receive the trainer's Operational Test Readiness Statement (OTRS) before proceeding with testing.

5-153. Opposing forces (OPFOR)
In those tests where OPFOR is included, the units portraying the enemy must be trained to employ the tactics of the threat force. The employment of U.S. tactics and procedures by OPFOR may invalidate or cast doubts on results of such a test.

5-154. Controllers
As a minimum, controllers will be completely familiar with the control plan and the data collection plan. They must be capable of making sound independent decisions on control matters in the absence of communications and should be able to act as data collectors should the need arise. They should also be able to implement emergency procedures.

5-155. Data Collectors
Training for data collectors will include instruction on the control plan and the data collection plan. Particular emphasis should be given to the need for accuracy and unbiased objectivity. Data collectors should be able to act as controllers and implement emergency procedures, if necessary.

5-156. Data Reduction and Quality Control Personnel

Training for data reducers and quality control personnel will provide familiarity with the data reduction plan and quality control procedures. Formal instruction is usually necessary, and training time and other resources must be planned accordingly. Practical exercises with substitute data will provide the best preparation.

5-157. Test Directorate and DAG Personnel
These personnel will be completely familiar with all aspects of the test. Some formal instruction is usually necessary, and training time and other resources must be planned accordingly.

Section XI
Test Support Planning

5-158. Test Support Defined
Test support addresses the categories of general administrative, materiel, and service support necessary for the performance of overall test activities. It includes general support functions to support both field testing and garrison administrative requirements.

5-159. Need for Test Support
Each OTE iteration requires a Test Support Plan (TSP) which results in adequate, effective, and timely test support for testing. Test support encompasses the requirements for items including but not limited to: equipment (vehicles including rental cars, generators, heating and air conditioning, special fabrication items; locally procured equipment such as copying machines and other office equipment, military standard items); facilities and base support (including offices, shelters, latrines, electricity, telephones and other communications equipment, sites, and any necessary range construction); supplies; ammunition; and fuel (MOGAS, JP-4, diesel). Schedules are developed for delivery of test support items and the use of facilities, ranges, and equipment.

5-160. Determining Requirements for Test Support
The concept for test support is jointly prepared by test support personnel and the test officer and describes the support to be provided in order to meet requirements of the test. It permits quick identification of problems and resolution of requirement misinterpretations prior to test. If identified requirements cannot be met, the issues are raised to appropriate levels for resolution. The operational tester determines the extent of support necessary. He develops specific plans accordingly. General requirements for test support should evolve through the

test planning cycle into specific requirements, and be recorded in the TSP.

5-161. Documentation of Test Support Planning
This section provides guidance for incorporation of test support planning for OTE. This planning results in development of the support paragraphs in the TEP, the Test Support Concept Appendix to the TEP, and the Test Support Plan Appendix to the DTP. This section applies to all OT. Tests of major systems may require most of the elements in the plan. Tests which are less complex may not requíre all parts of the plan, however the topics cans be used as planning guides to insure adequate consideration of these areas is included in test planning.

5-162. Test Support Planning Process
As for the other support planning requirements, the details of test support requirements and planning are identified and documented during planning for the operations and data collection/reduction requirements. The test officer will normally have a test support officer or NCO assigned as a member of the test team. The test support officer/NCO coordinates the documentation of the test support requirements and formalizes the requirements in the test support plan. Planning must provide necessary test support to the test site. This section explains how support planning occurs, and discusses details of how to develop and write support plans for tests. The section describes plans in detail but allows flexibility for the tester to tailor the plan for his specific test.

5-163. TEP Test Support Concept
This optional appendix to the TEP contains details of planned test support not contained in the main body of the document. It is expanded into the TSP in the DTP. The concept has no fixed format, but using the order of presentation given for the TSP provides complete coverage of the subject and permits easy expansion from the concept to the plan.

5-164. Test Scheduling
Development of an implementation schedule is paramount to an TSP. This schedule must be in consonance with the overall test schedule to allow adequate planning and development time for support of the test. The support plan is the responsibility of the tester. The tester, in turn, assigns a Test Support Specialist with requisite technical expertise to help prepare the plan.

5-165. Preparation of the TSP
Test support requirements are prepared by the tester. They describe the support to be provided in order to meet requirements

of the OT. Support needed is based on requirements developed during overall test planning. Planning for test support is an iterative process which begins with general test needs and evolves into a specific support design. The central document for planning is the TSP which satisfies and documents requirements and provides bases of understanding between testers, evaluators, and test support personnel. Detailed instructions for development of an TSP are provided in Figure 5-9.

(INSERT FIGURE 5-9)

5-166. Test Concept in the TSP
This section of the TSP describes the support concept and is composed of the subsections detailed below:

a. Purpose.

b. Scope.

c. Approach to Test Support.

d. Organization for Test Support.

5-167. Logistics Support of Test
Logistics support is generally discussed in terms of six areas:

a. Supply. The supply requirements and schedules for delivery, storage, and distribution of all types of expendable and nonexpendable supplies required to support the test. The supply function involves the acquisition of items such as cabinets, typewriters, and support vehicles. Required control and accountability procedures are described (it is not necessary to reiterate normal supply and accountability procedures provided in AR 735-11).

b. Maintenance. The requirements for the support of all administrative equipment to be used in the test. Maintenance of the test item is performed in accordance with the maintenance concept developed for the system and includes management of maintenance operations, facilities, and repair parts supply.

c. Transportation. The administrative transportation support of the test directorate and related activities including transportation for player units, movement of the test item and all test support items to the test site, inspecting and accepting these items, and preparing the test item for shipment after the test.

d. Facilities. The requirements for the use of real property facilities such as ranges, maneuver areas, test courses, airstrips, railheads, weather stations, office space, communications, dining facilities, recreation facilities, places of worship, and storage space. Test-unique construction and maintenance of real property are also included.

e. Services. The requirements for local services to include security guards, billeting, garrison and field rations, clothing issue, laundry service, and special services for troop morale. Includes the self-service supply center support by the installation.

f. Medical. The medical support plans which are prepared in coordination with the responsible command/staff surgeon. These plans ensure that preventive medicine, treatment, medical evacuation, medical supply, and emergency communications are available to adequately support the test directorate and player personnel. Medical and health considerations associated with the tested equipment are also addressed.

5-168. Communications

Planning for communications consists of identification of the communications systems required to support the test. Development of the control and data management plans provide the basis for communications planning. The core of the communications plan is development of radio and wire nets for test organization control, players, OPFOR, controllers, and data collectors. Once requirements are determined, the net designs provide the basis for requesting equipment, personnel, and frequencies.

5-169. Detailed Cost Estimate

A detailed cost estimate is revised estimate of the funds required for the test. The format is the same as that used in the OTP. Changes in the estimate from the OTP version should be clearly identified.

5-170. Safety

The safety plan section describes the procedures used to ensure safe conduct of the test to include a safety briefing (usually given by the chief controller) to all player and test directorate personnel based on the system safety release. In particular, it identifies required safety officers, and specifies procedures to ensure that operators of any potentially hazardous equipment are fully trained. Tests posing unusual or potentially hazardous conditions that involve risk beyond the normal call of duty require approval by the Surgeon General and are to be conducted within the provisions of AR 70-25. The system safety release is also included or referenced.

5-171. Electronic Warfare
The electronic warfare plan is a detailed set of instructions, procedures, and schedules for those portions of the test involving electronic warfare. It is applicable when electronic warfare is a major condition of the test but not the purpose or major objective.

5-172. Visitor Control
The visitor control instructions document requirements for visitor control, briefings, security clearance verifications, conferences, field tours, transportation, special equipment (such as laser goggles, boots, and field pants), and other related details.

5-173. Public Affairs
The public affairs plan describes the measures to process requests or actions from the news media and local populace. Paragraph 3-29, AR 360-5, sets the Army policy on media coverage of Army test activities. It states: "The Department of the Army does not permit media coverage of developmental, technology validation, or operational testing of Army systems." Consult with the local public affairs officer for details.

5-174. OPSEC
The OPSEC plan addresses the sensitive aspects for the test, the hostile threat, the vulnerabilities, countermeasures, OPSEC training, and priorities of the test. If appropriate for the test's classification, the test officer must plan for the protection of such information as communications (document or electronic means), informative patterns and signatures (visual, acoustic, electronic, or infrared), and stereotyped procedures (tactical, physical, or administrative).

5-175. Security
The security plan encompasses all activities required to ensure internal physical security at the headquarters area and the security of the test site along with their associated property to include the tested system. Coordinate this plan with your security manager. The security manager should also be consulted on access badges and security clearances.

5-176. Long Lead Items
The necessity for long lead time procurement and/or processing requirements will often occur in the test process. The test officer must be sensitive to the early identification of these requirements and to identify and conduct the actions necessary to start the process to obtain the materiel and/or services required. The following paragraphs include areas of potential

long lead time items which should be considered by the test officer in this process.

a. Ammunition. Will special ammunition or ordnance be required?

b. Aircraft. Will tactical and/or special purpose test support aircraft be needed?

c. Instrumentation. Will special purpose or other instrumentation be used that involves lengthy procurement details and time?

d. Personnel Skills. Are military personnel, contractors, or civilians with unusual skills, qualifications, or training needed?

e. Equipment Fabrication. Do mockup targets, support structures, or other electromechanical devices need to be fabricated?

f. Contracts. Are advertised or negotiated contracts necessary?

g. Environment. Does the test produce environmental concerns or impacts that must be resolved prior to test start?

h. Target Alteration. Are changes required in existing equipment configurations or tactical aircraft? Does new equipment need to be installed? If so, an airworthiness release must be obtained.

i. Permanent Construction. Will there be any permanent construction requirements or alterations to existing permanent base and range facilities (B&RF)?

j. Electrical Power. Do firm power facilities need to be installed?

k. Liquid Petroleum Gas/Water/Septic Tanks. Are liquid petroleum gas, water lines and sources, or septic tanks required?

l. Nonstandard Stock. Are there any demands for nonstandard or nonstocked supplies of equipment items? The cost and availability must be determined in advance.

m. Rental Car Support. Are rental vehicles, vans, or other transportation facilities required?

n. Telephone/FAX Lines/Radios (Communications). What telephone capability (class A, DSN, etc.), facsimile lines, radios, or other communication media are needed?

o. Computer Support. What computers for large-scale data collection and processing are required? Are PCs for onsite or data reduction centers needed?

Section XII
Prerequisites for Test Initiation

5-177. Operational Readiness Statement (OTRS) Requirements

a. Prior to the start of the test, the MATDEV, CBTDEV, and TNGDEV each provide the operational tester with a written statement of the system's readiness for OT. The operational tester specifies in the OTP milestone schedule the suspense dates for the OTRS (normally 90 days prior to the test start date).

b. Deviations from the required readiness standards for test (e.g., system safety, training) require a statement of explanation by the OTRS proponent (MATDEV, CBTDEV, TNGDEV).

c. For ACAT I and II OT, conducted in support of a MS III production decision (beyond LRIP decision), the MATDEV OTRS must certify that the system is ready for a dedicated phase of OTE (DODI 5000.2).

d. The operational evaluator reviews the OTRS to ensure that identified deficiencies will not affect the ability of the OT to answer the test issues.

e. Prior to the start of test, the operational tester forwards the OTRS to the appropriate decision authority for information or resolution of disagreements and concerns.

f. For operational tests not conducted by OPTEC, information copies of the OTRS are provided to OPTEC. An OT will not be initiated until all OTRS have been received and reviewed.

5-178. MATDEV OTRS

a. The MATDEV describes the system to be tested in terms of size, shape, weight, transportability, and functional characteristics.

b. For software-driven systems, the MATDEV specifies the software version to be tested and current documentation to be

made available. A detailed statement of how both the system hardware and software characteristics differ from a fully representative IOC system is provided, if appropriate.

c. The MATDEV identifies the DT objectives which have been met and all failures and deficiencies which have been corrected. Any DT objectives not met or failures not corrected will be detailed, and estimates of their effect on OTE described.

d. The MATDEV identifies special instrumentation required and the availability of that instrumentation through his office.

e. The MATDEV identifies the system maintenance, training, and supply resources requirements which are to be evaluated during test. Military resupply procedures, support procedures and special support requirements are defined. If contractor support is called for, the specific role of the contractor is defined at each echelon.

f. The MATDEV estimates the current and projected RAM performance in terms of the system ORD.

g. The MATDEV includes a detailed statement concerning any restrictions to ordinary operations under field conditions which will exist in the test.

h. The MATDEV provides a Safety Release for the system (obtained from TECOM) or identifies the status of the release.

5-179. CBTDEV OTRS
The CBTDEV OTRS verifies that the doctrine, organization, threat, logistics concept, crew drill, and standard operating procedures (SOPs) in the CBTDEV's support packages are complete, represent planned employment, and are approved for use during OT.

5-180. TNGDEV OTRS
The TNGDEV OTRS verifies that the training concepts and materiel and crew drills included in the training support package are complete, representative of the training package to be used at fielding,, and approved by TRADOC for use during OT. In addition, it verifies that the user troops have satisfactorily complete training in accordance with the training support package and are ready for test.

5-181. Test Unit OTRS
A signed OTRS is required from the test unit commander. This certifies that unit personnel are MOS qualified through use of SQT, CTT, and where appropriate, ARTEP tasks. This statement

does not certify that unit personnel are trained on the test item.

5-182. Test Support Packages
Test support packages are required from the MATDEV, CBTDEV, and TNGDEV prior to commencement of testing. A description of support packages can be found in Chapter 3 and Part One of this pamphlet. Milestones for submission of the support packages are contained in the TSARC-approved OTP. All of the support packages are equally important; however, development and delivery of the system support package (SSP) must be closely monitored because lack of a complete SSP will prevent initiation of an IOT or FOT, unless a waiver to proceed is obtained IAW AR 700-127. The existence of an incomplete SSP will be classified as a critical test incident and reported by message.

5-183. Safety Release

a. A written system safety release obtained from TECOM must be on hand prior to initiating any training or testing involving user troops. The test officer must ensure TRADOC proponent schools and all test directorate/test player personnel are knowledgeable of safety precautions/procedures. At the T-60 OTRR, the program sponsor or other agency responsible for the safety release will provide same to the test officer.

b. TECOM normally provides safety releases for hardware systems on a reimbursable basis. The program sponsor or the test requestor (in the case of FDTE, CEP test, and customer test) is responsible for funding TECOM to develop the safety release per AR 385-16. Funding for the safety release will be included in the OTP. To assure timely receipt of the safety release, the operational tester must proactively coordinate with the activity responsible for generating the safety release.

c. For NDI, the safety release is provided by the procuring agency (MATDEV or the CBTDEV), as appropriate. In all cases, the safety release is provided by the MATDEV or the CBTDEV.

d. A copy of the safety release is provided to the commander of the organization supplying the troops to ensure that the organization is informed of the risks identified. For weapon systems, both live fire and non-fire safety releases may be required.

e. Where appropriate, the safety release indicates the results of The Surgeon General (TSG) investigation of medical or health problems related to the materiel system and includes a

certification as to the safety of user troops. User test using aircraft require an airworthiness release (See AR 70-62).

5-184. TEP
The TEP should be approved as described in Chapter 3. If the TEP is not approved, the TEP will be a high interest item for the T-60 OTRR. Test initiation will not occur without an approved TEP.

5-185. Test Limitations and Waivers
The tester informs the independent evaluator of each and every test limitation and all requests for waiver to the test program that have been approved by the appropriate decision authority.

SECTION XIII
Operational Test Readiness Review (OTRR)

5-186. OTRR Purpose
OTRR are conducted prior to each OT test to allow Commander, OPTEC (or any other operational tester) to assess the overall readiness for test of the system. The OTRR determines readiness of the system, support packages, instrumentation, test planning, evaluation planning, etc. to support the OT. The OTRR includes identification of any problems which impact the start or adequate execution of the test and subsequent evaluation or assessment of the system. The objective of the review is to determine if any changes are required in planning, resources, training, equipment, or timing to successfully proceed with the test.

5-187. OTRR Composition

a. OTRR are chaired by Commander, OPTEC, the commander of any other operational test activity or their designees. The Commander, OPTEC chairs all OTRR for ACAT I, ACAT II, MAISRC, and DOD Oversight systems. He may delegate the chair for a specific OTRR. OTRR for non-major, non-oversight systems and for FDTE, CEP, and CT will be chaired by Commander, TEXCOM. He may delegate the chair for a specific OTRR.

b. Principal OTRR attendees include the operational tester, operational evaluator, MATDEV, CBTDEV, TNGDEV, logistician, developmental tester, developmental evaluator, command providing user troops for test (normally FORSCOM), HQDA staff elements, host installation, and contractor.

c. The operational tester (Test Director or Test Officer) will be responsible for planning, administrative support, and reporting results for the OTRR. For full evaluate systems, the

tester works in close coordination with the operational evaluator to schedule the OTRR and establish the agenda.

5-188. OTRR Schedule
Three OTRRs are essential for most post-Milestone I OT. When necessary, any of the participants may request the chair convene an additional OTRR. An OTRR may not be used for purposes which are outside its intended scope such as system reviews. The three essential OTRR are:

a. An action officer level review (which is chaired by the operational tester) at approximately 9 months prior to test (T-270), held in conjunction with a TIWG. This review focusses on identifying those activities and actions, if any, that appear to be moving too slowly to support the test start date or proper test execution. At this meeting, any misunderstandings on the identity of activities responsible for elements of test planning, readiness, and execution are resolved. For selected high-interest tests, this OTRR may be elevated to a GO-level OTRR.

b. A review prior to resource (player, testers, and equipment) deployment to test site (normally 2 months prior to test at T-60). A primary consideration of this review is to ascertain if any known problems exist which would delay test start, and to preclude incurring deployment costs when the test start date is in jeopardy. At this review, resource providers confirm their readiness to release the resources to the tester. MATDEV, CBTDEV, TNGDEV, and test unit OTRS are provided to the tester at this review. The Safety Release should be provided at this OTRR, but must be provided prior to beginning of hands on training of test players.

c. A review prior to the beginning of record test in order to determine if the tested system, players, testers, ITTS, and data reduction procedures are ready for testing for record. This OTRR is normally conducted at the test site during latter phases of, or immediately following, the pilot test. In addition to topics addressed during previous reviews, data collection and data reduction techniques, functions of automatic data processing systems, validity of pilot test data, and operations of the DAG, if appropriate, are examined. The test officer and the evaluator confirm the success of end-to-end data runs.

5-189. Pre-OTRR
A pre-OTRR is normally conducted the day prior to the official OTRR. The pre-OTRR is an action officer level meeting which attempts to reduce known problems by developing solutions and milestones prior to the OTRR. Normally, only matters that could prevent valid testing (potential "showstoppers") are briefed at

the OTRR. In those cases where the T-270 OTRR is conducted at the action officer level, there is no need for a pre-OTRR.

5-190. OTRR Product
The resultant product of each OTRR is a decision by the chairman to execute the T&E as planned, to direct required changes to ensure successful test execution, or to recommend (to the program decision authority) delay or cancellation of OT. The operational tester (normally OPTEC) has authority to suspend start of testing if readiness of the materiel or IMA system offers less than a reasonable chance of meeting established criteria, including posing undue hazards to personnel or equipment (AR 73-1). OT may also be delayed when it becomes evident that critical test data or information cannot be obtained to adequately answer the issues.

5-191. OTRR Preparation

a. OPTEC (or other OT activity) will be responsible for scheduling the OTRR. Attendees will be notified of a scheduled OTRR and the planned agenda at least 30 days prior to the review.

b. A typical OTRR agenda is provided at figure 5-10. It should be used as a guide in developing an appropriate agenda for a particular system. Mandatory subjects for briefing by the tester at all OTRRs are specifically identified. The agenda should always include provisions for the MATDEV, CBTDEV, TNGDEV, and test unit commander to provide their OTRS, which formally addresses system readiness for OT. Additionally, prior to OT to support the Milestone III decision, the program manager certifies the system is ready for a dedicated phase of OT.

(INSERT FIGURE 5-10)

5-192. OTRR Documentation
Minutes of an OTRR are distributed to OTRR participants within 10 working days after adjournment of the OTRR. Within 3 working days after adjournment of the OTRR, external commands or agencies are notified by either message or memorandum of any issues or problems surfaced during the OTRR for which their agency has responsibility for resolving prior to test start. The message may solicit the personal assistance of the agency commander in overseeing necessary corrective actions. Within 5 working days after adjournment of the OTRR, a status report outlining the results of the OTRR is provided to the appropriate decision makers. The format and addressees are determined on a case-by-case basis by the chairman, based on the outcome of the review and degree of assistance required to resolve outstanding issues.

5-193. Delay or Termination of Operational Testing

a. In the event that an OTRR indicates that testing should be delayed (i.e., inadequacies of SSPs, OTRSs, training, test planning, instrumentation, etc., which will adversely affect test start, execution, or its realism and/or completeness), alternative courses of action and recommendations are developed which, if executed, assist in maintaining the integrity of the test.

b. Due to one year notification requirements for provision of resources for support of OT, a seemingly short delay in the start of the OT result in a delay of a year or more (see AR 15-38).

c. If a determination is made that suspension of testing is necessary, the chairman expeditiously forwards the issues and recommendations to the decision authority, with information copies to the MDR principals, for a decision to start, delay, or terminate the test.

Section XIV
Pretest Activities

5-194. General
These activities involve all pretest training, organizing for execution and support, preparation of equipment and test areas, the pilot test, adjustment of plans (if necessary), and all other actions required to prepare for the test. The training plan and support plan are of major interest during these activities.

5-195. Training Phase

a. Regardless of the type of test, some evaluation of training and training support is normally conducted. This is necessary to ensure the skills and knowledge necessary to operate and maintain a system can be attained and sustained within realistic training environments by units using personnel of the type and qualification expected when the system is deployed. When training is an issue, MANPRINT and training data collection must begin prior to T-date (at the start of player training).

b. Conducting new equipment training (NET) is the MATDEV's responsibility. NET transfers knowledge gained during materiel development to trainers, users, and support personnel during development and fielding of new equipment. The contents of the NET SP are described in Part One.

c. TRADOC is responsible for the analysis, design, development, implementation, and control of resident training programs and exportable training products. The TRADOC school responsible for the MOS affected by the test item will prepare a training TSP with contents as described in Part One.

d. The extent of training and training support evaluations is contingent on the test type and stage of development of the system being tested. Ordinarily, training is contractor-administered in the early phases of materiel development. For subsequent phases, the MATDEV provides training to military instructor personnel, who then train test participants. The objective, however, remains the same: to assess the adequacy of training associated with fielding the system.

e. Test officers are responsible for ensuring that test directorate and player personnel are adequately trained. This often requires coordination with support divisions and TRADOC proponent schools. It is also important to ensure that test player personnel satisfy test requirements in terms of MOS and skill level. Training includes that necessary for controllers, support personnel, data collectors, and data reducers.

f. Training conducted in support of tests will include training individuals, crews, and units in individual and collective tasks required to employ the system in accordance with approved doctrine and tactics. Training will be in accordance with the training SP and representative of that intended to support the system when initially fielded. The proponent TRADOC school must provide the test organization and Headquarters, TEXCOM with certification stating test players have been trained and can perform individual and collective tasks to standard in accordance with the milestone schedule in the OTP. This written statement constitutes one element of the OTRS but is provided separately from other elements of the training developer's OTRS.

g. All training provided to player personnel, any performance problems during the test attributable to inadequate training, and comments of personnel who received the training must be recorded and subsequently analyzed.

h. Data are collected during the training phase if required by the TEP, If the TEP does not require training phase data, the test officer may wish to collect these data as a training device for his data management personnel and as an opportunity to perform an end-to-end data run.

5-196. Test Support

Adequate support is essential to any test execution. The test officer must ensure that all logistical and administrative requirements that are planned or becomes necessary for the test execution are properly performed. The requirements and plans for support are documented in the test support plan for the test.

5-197. Pilot Test Phase

a. A pilot test is an abbreviated version of the actual test and is conducted in advance to detect deficiencies in the plan, instrumentation, data collection, data management and test control. It includes the exercise of each type of required event and makes use of each data collection means. It is essential that the complete data management procedure, to include DAG operational procedures, be verified as a part of the pilot test.

b. The pilot test is provided for in the test design plan with sufficient time between pilot test and the start date of the actual test to allow for identification of, reaction to, and correction of any deficiencies encountered. Tests relying heavily on instrumentation may require additional time after the pilot test for the correction of problems. Accomplishment of an abbreviated program of events is usually sufficient, although an abbreviated control procedure may also be required.

c. If a pilot test is not required, it is to be explicitly stated in the TEP. When extensive training of player personnel is required, a pilot test may he conducted concurrently with the training test phase.

d. Problems revealed during the pilot test are to be corrected prior to the actual test. This may involve the conduct of additional training, identification of additional support, resources, changes to the DTP, or revision to the TEP.

e. The length of the pilot test must permit the exercise of every type of major event required in the test, as well as every type of data collection instrument to be used. There should be enough workdays between the end of the pilot test and actual T-date to incorporate any necessary changes.

f. Test directorate organizations must duplicate those envisioned for the actual test and all directorate members must participate. The degree of player participation must be tempered by considering if learning during the pilot test would bias results of the actual test.

g. Data should be collected and reduced in the same manner by the same personnel to be used during the actual test. A complete

end-to-end data run must be conducted. This starts with test events and goes through every step until a data base is created.

h. All manual data collection forms must be validated and all instrumentation, from stopwatches to computers, used. The need for filming test events should be carefully reviewed. Video tape is an excellent way to record data; however, the data reduction and analysis effort associated with this medium can be lengthy and tedious.

i. If the test involves a two-shift operation, data review procedures must be established and validated during the pilot test.

(1) One of the best methods of injecting quality control into the data collection effort is for the data manager or assistant data manager to be present at the shift change to review collected information. All data collection forms must be complete; for example, all blocks filled in, narrative comments legible, dated, and signed.

(2) Incomplete forms indicate the data collector does not understand his job or he is not interested in doing his job right. In either case, the problem must be resolved prior to the test commencement.

(3) Requiring individuals who have just worked a 12-hour shift to remain on duty until their forms are corrected is a good way to communicate the idea that the data are important and anything less than perfection is unacceptable.

(4) The conduct of data reviews and debriefings at shift changes is essential.

j. Upon completion of the pilot test, all test directorate personnel should be critiqued on their performance and encouraged to surface questions and discuss problems they encountered. It is essential for all test directorate personnel to understand their responsibilities and to know who to contact should a problem occur.

k. Ensure adequate provisions exist for such things as mess, billets, transportation, communication, drinking water, and coffee. Adjustments may be required to correct deficiencies revealed. This may involve conducting additional training, requesting additional support, revising control procedures, altering the test directorate organization, and revising data collection forms.

l. All problems surfaced during the pilot test must be addressed. They will not go away during actual testing. All issues will be discussed and resolved at OTRR 3, the last OTRR. It will be chaired by the Test Director. This review will give the go-ahead to start the test.

m. Contingent upon the desires of the test proponent, customer, or approval authority, data collected during training and the pilot test may or may not be considered valid. This is particularly true for RAM data. Use of these data should be in accordance with the approved TEP and associated FD/SC. These data must be comparable and compatible with the data from record trials. If any of the data from the pilot test is used as data in the test report, it must be obtained under the same test conditions as the record trials.

Section XV
Test Conduct

5-198. Test Structure
The heart of test is typically divided into sub-tests or phases which are controlled by operational scenarios consisting of trials and events. Tests may have as many phases as necessary. Typically, an FTX maneuver will suffice. Phases may be conducted at separate locations, separate test facilities, or at one location or facility. A class of sub-tests is special exercises and excursions. These sub-tests are typically small-scale series of events, or special circumstances used to explore special cases or particular situations which do not occur naturally in test. They can originate based on unexpected results from current test, questions raised by senior management, or attempts to answer "what if" questions.

5-199. Adherence to Test Design
After completing all necessary adjustments to the TEP and DTP, the test officer must ensure that the test is conducted according to the updated plans. Test change proposals (TCP) must be approved by the same headquarters that approved the TEP (see Chapter 3). Major deviations from the test plan, such as those which require changes in test milestones or which affect the potential accomplishment of one or more sub-objectives, are to be immediately brought to the attention of the test proponent and other appropriate commands and agencies. All deviations from the approved TEP are immediately and fully documented and reported. When retesting or necessary extensions to the test impact on program schedules, the CBTDEV, MATDEV, and the operational tester

are to recommend alternative test programs and risks to ASA(RDA) or other appropriate approval authority.

5-200. Test Changes
During the test, it may become apparent that deviation from the TEP or DTP is required. Minor adjustments to these plans are frequently required during test execution, and are made by the test officer. The test officer should consult with the analyst assigned to support his test to determine the impact that his changes may have on the statistical validity of the test. The test officer must also ensure that he adheres to the policies established within his test activity for implementing minor adjustments to the test plan. Major deviations from the test plan, such as those which require changes in test milestones or which impact on answering one or more issues, should immediately be brought to the attention of appropriate personnel. Any changes to the approved TEP must be approved by the headquarters which approved the TEP through submission of a TCP.

5-201. Checklist
During the various phases of a test, the test officer has many actions that need to be completed. To help ensure that these actions are performed on time, a test execution checklist has been developed and is at figure 5-11.

(INSERT FIGURE 5-11)

5-202. Test Officer Log
The test officer log is a notebook, preferably with numbered pages, that enables the test officer or representative to record indelibly (no erasures) all the major events of the test, beginning at the start of the pilot test. A chronological order with events listed in military time is the most convenient format. They include, but are not limited to, weather conditions, personnel injuries, equipment or instrumentation conditions, absences of test or player personnel, threat simulator status, test anomalies, adequacy of collected data, security and safety matters, mission start and stop times, frequency authorization and usage, reasons for any delays, and any incident requested by the data analysts to include in the TR time event charts. The test officer log is the official on-site record of test events. The exact format should be determined prior to T-date. The log should be complete and faithfully maintained.

5-203. Test Schedule
Once the test begins, the test officer is responsible for seeing that the approved plan is followed. This requires substantial supervision and control of all resources dedicated to the test.

He must ensure that the prescribed scenario is followed, that support activities are functioning, and that data are collected and stored properly. OPSEC of data and equipment is a major concern. Equipment left at the test site overnight must be protected from damage by the elements and from theft or vandalism. The test officer must also ensure that the safety plan is followed. Duties such as presenting briefings should be delegated to assistant test officers.

5-204. Quick Look Reports
Information from the test officer log and other sources can be summarized in the format of a cursory "quick look" report. This information may be disseminated in accordance with test directorate standard operating procedures or prior agreements. The test officer is responsible for the contents and accuracy of this report. It should be limited to one or two pages and provide basic information for a specific area. No quick look report should be disseminated outside the test directorate without written release by the director or other appropriate authority.

5-205. Visitors and Briefings
The test officer must be prepared to thoroughly brief visitors on the purpose, scope, and conduct of the test. Resources necessary to do this must be planned and included in the OTP. Resources may include facilities, transportation, quarters, and dedicated briefing officer. Coordination will be required with the local installation protocol officer for VIP visitors. The test officer can control a large number of visitors by scheduling a visitor's day just prior to start of the pilot test. In this manner, a large number of PMs, CBTDEV, MATDEV, unit chain of command, and other visitors will be accommodated without impact on record trials. Visitors day also serves as an internal check to ensure everything is ready for T-date. During the conduct of record trials, it is inevitable that visitors will arrive and a thorough plan with an updated briefing is required to answer their questions and minimize interference with record trials.

5-206. External Personnel
During testing, there may be numerous personnel on site. Some will stay for the duration of the test. Personnel from PM, TSM, CBTDEV, MATDEV, TNGDEV, and DT agencies are vitally interested in OT. The test officer's primary mission is the conduct of the test. To do this more efficiently, the test officer should establish early and firmly plans to accommodate personnel not assigned directly to the test team.

5-207. Test Incident Reporting

During test execution, each intermittent or incipient malfunction, safety hazard, or degradation in system performance or operation is to be documented in a test incident report (TIR) prepared by the organization conducting the test. TIRs provide a standard method of reporting incidents disclosed during materiel testing. Copies of TIRs describing significant major acquisition program T&E events as defined in the TEMP (such as missile launches or live firings) are provided to the DOTE and DDDRE(T&E) within 24 hours after the event (AR 73-1).

5-208. Postponement of Testing

a. In the event that an OTRR indicates that testing should be delayed (i.e., inadequacies of SSPs, OTRS, training, test planning, instrumentation, completeness, safety or health hazards), alternative courses of action and recommendations are developed which, if executed, assist in maintaining the integrity of the test. Due to resource provider 1-year prior notification requirements for UTs, seemingly short delay requirement could result in a delay of 1 year or more (See AR 15-38).

b. Scheduled testing may be postponed upon identification of a major problem (i.e., those problems which would impact the validity of the data being collected to address critical issues) during testing or, when it is apparent that the system performance has little chance of successfully attaining operational criteria. User Testing may be delayed by the user tester.

c. Initial approval to postpone a test must be obtained from within the test and evaluation organization. The proponent or evaluator, if not previously informed, and the materiel developer (if the test was for a materiel system) will be notified of the suspension within 24 hours. Notification will include the rationale for the action. Resources will not be released without the permission of the headquarters which approved the TEP.

d. Upon suspension, the program sponsor will convene a program review to consider future actions. Once the program sponsor has a solution to the problem, the TIWG will be convened to determine necessary additional tests to validate the fixes. Before restart of testing, appropriate test readiness reviews will be conducted with the same level of participation as in previous OTRRs.

e. Only the headquarters which approved the TEP may terminate a test prior to completion. Termination involves the release of resources.

Section XVI
Test Data Management

5-209. Overview
The following sections provide details of test data management processes, the levels of test data and their relation to the test report, and presents some suggested procedures for use during the data collection, reduction, and analysis processes.

5-210. Purpose
The purpose of data management is the collection, quality control, reduction, and storage of test data generated during test execution into a more condensed and usable format for analysis and, ultimately, into test results and evaluation.

5-211. Pilot Testing
The process of data collection and reduction should involve collecting and processing data during the pilot test as well as the record test. Obviously, not all the data are available during early test execution, but the test officer/analyst must start the data reduction phase as soon as possible in order to reveal unusable data and meet test reporting milestones. No system should proceed into record test until end-to-end data runs have been successfully performed in the pilot test for each element of the test data base. This will be a prime agenda item at the OTRR just prior to start of test.

5-212. Data Tracking and Audit Trail
The OT results have a great potential to influence the overall decision-making process; therefore, great care must be exercised to ensure that they are properly formulated to accurately depict the results of system performance during the test. The method and rationale used to collect, record, and process the test data and to derive test results should be recorded to maintain an audit trail and facilitate report writing.

5-213. Data Management Requirements
Requirements for test data management are depicted in the Data Management Plan (see above). The data management requirements describe the data management organization and procedures used to ensure that the test data base accurately reflects what occurs during the test. Data processing are the procedures through which recorded test data is organized, reduced, verified, managed, controlled, and stored. Data management personnel organize the data in terms of the collection source (RAM collection form, cockpit digital recorder, radar tapes, etc.) and perform the planned procedures through which each set of

collected data pass before reaching the storage medium which supports the test directorate and the evaluator.

5-214. Data Processing
Data processing is described in the ASP (see above). Data processing begins when completed, properly formatted data are received from the data collection section. It ends when the final test data base is produced. This includes:

a. Entering manual and automated data into an automated data base.

b. Performing both manual and automated reduction.

c. Execution of quality control procedures.

d. Constructing and maintaining files to provide a complete test data audit trail from collection (instrumentation tapes, videotapes, and paper files of original manual data forms, data collector logs, controller logs, interviews, etc.) through any interim reduction process to the final test data base.

5-215. Data Flow
The data flow, both within the data management section and between elements of the test directorate must be developed and documented for use. It documents procedures and schedules to be used for data transmittal especially manual transmittal operations. Automated formats are described in detail in the ASP. The data flow includes procedures where data is combined with other data, where it is processed, scored, reorganized, validated, or otherwise manipulated. This includes transfer of data from data forms to automated form. Particular attention is paid to feedback loops, both within the data management section and among data control, collection, and management elements. In addition, feedback loops from emerging evaluation and statistical analyses are generally established.

5-216. Organization for Data Management

a. The organization of the data management section, including functions and responsibilities of key section personnel and personnel rotation schedules must be established and provided to all personnel. Responsibilities of key personnel and overall organizational structure are designed to accommodate data entry, data reduction and validation, and audit trail preservation.

b. The data management section typically requires personnel from several agencies or contracting organizations at many different levels possessing skills from a wide variety of

disciplines. Organization of the section should allow for unusual duty schedules or frequent rotations of technical personnel to permit timely reduction of test data and to accommodate personnel constraints of other agencies.

c. Training for data management personnel on the flow of data and procedures to be used within the section and on responsibilities of section personnel must be planned and conducted. Training is to be tailored to meet individual needs. Duties of personnel within the section tend to be specialized, ranging from entering and filing data to reviewing reliability and maintainability descriptions.

5-217. Data Requirements Support
Instrumentation, AV, and ADP must be incorporated into data management planning for OTE. This planning results in development of three specific documents which are incorporated into the DTP: the ISP, the AVSP, and the ASP. Each of these plans were described previously in this chapter. Each of these plans provide the details of support to the data management processes as described below.

a. Instrumentation. Scientific or technical equipment, to include threat simulators and targets, used to measure, sense, record, transmit, process, or display data during tests, examination of materiel, training concepts or tactical doctrine.

b. Audiovisual (AV). Audio and visual documentary coverage of how testing was conducted, as well as collection of selected data elements for incorporation into the report. The AV documentation covers the testing and other tester activities to include test unit, test directorate, side tests/demonstrations, instrumentation, data collection, and data processing.

c. Automated Data Processing (ADP). Input, storage, computing, control, and output services of test data, using electronic circuitry within a computer system to perform arithmetic and logical operations by means of internally stored or externally controlled programmed instructions

Section XVII
Test Data Collection

5-218. General
The data collection process includes the organization and procedures which will ensure that all required data are collected correctly, verified, and properly formatted for storage,

retrieval, and analysis. Data are usually collected in three different ways.

a. Automated instrumentation with associated data bus and data distribution system, including telemetry links recorded on hard disks or magnetic tape.

b. Manually by data collectors with data collection sheets for specific portions of the test such as RAM, MANPRINT, or notebooks, including the TO Log that are annotated by key test or player personnel.

c. Optically or acoustically with video cameras, microphones, or other transducers that have a self-contained recording system.

5-219. Organization for Data Collection

a. The organization and procedures for data collection (and quality control of the collection process) must be established to ensure that data collectors and instrumentation will be in the right places at the right time. It must describe when, where, and how checks of data forms or instrumentation outputs will be made to ensure that data are being collected and recorded according to the definitions and formats required.

b. The data collection section typically consists of teams which are assigned to data collection stations. These stations may be moving (e.g., with a tank in the attack), permanent (e.g., at the same location for the whole test), or temporary (e.g., at a given location during only one part of the test).

c. Whereas controllers are concerned with the test input or stimulus, data collectors are concerned with the test conditions and the output or response of the test item and player participants. Some data collectors may be tasked to operate automatic or semiautomatic data collection equipment.

d. As a minimum, procedures must provide for the following items:

(1) Composition. A chain of responsibility is established and mission statements are provided as required.

(2) Allocation of collection means. Each data recording agent (human or instrument) is assigned to a player unit or location, and the data to be collected are identified. These arrangements are closely dependent upon the control plan. Provisions are made for such items as relief of data collectors and instrumentation battery changes.

(3) Gathering. Procedures and schedules are established for the periodic pick up and control of manually recorded data from collectors. Prompt consolidation of data reduces the likelihood of loss and allows concurrent monitoring for incompleteness or error.

(4) Data recovery. Procedures are specified for attempting recovery of data which are lost or erroneously not collected. Such procedures are to be instituted quickly while the data may still be available or can most easily be reconstructed.

(5) Coordination. Plans are made for continuous monitoring of the test events. Changes in the sequence or timing of events may require reallocation of data collection means. This is best accomplished by coordination between the control headquarters and the data collection headquarters.

5-220. Data Collector Training

a. The training plan must include training to be given to data collectors and instrumentation operators as well as procedures to determine whether training was effective. Data collectors require familiarity with the control plan and the data management and collection plans, as well as the test issues, test scope, subtests and field exercises, test item characteristics, instrumentation, duty schedules, and communications procedures and radio nets.

b. Detailed training in the correct use of data collection forms is always required. Particular emphasis is given to the need for accuracy and unbiased objectivity. Selected data collectors and supervisors may require detailed training on operations or maintenance of the tested system.

c. Training is to stress that data collectors are not to cue test players to pending events. Data collectors should also be trained to implement emergency procedures if necessary.

5-221. Data Collection Forms

a. Data which is manually collected will require data collection forms. Proper data form design considers the data audit trail (in particular, providing space for identifying data collector and quality control reviewers) and the need to minimize or preclude entry errors or omissions. Form design guidelines include:

(1) A field requiring a certain number of characters or digits should have blocks or underlines which clearly indicate field length.

(2) Special formats should be indicated (e.g., MM:SS for a time in minutes and seconds).

(3) Multiple choice questions should generally not require data collectors to remember input codes but should either define the codes or provide for check-off blanks.

(4) Input of extraneous data should be avoided (e.g., requiring entry of year or even month for a test conducted 10-25 June 1988).

b. Some redundancy may be desirable to ensure the traceability of forms. For instance, a mission number could be paired with other records to identify system, date, location, etc., but a transposed or missing digit in either number could render a form entirely untraceable.

c. Data collection form instruction sheets are developed which describe when and how each entry on each data collection form will be obtained and entered. The definitions in the data element dictionary in the TEP and the data reduction plan are considered when preparing these instructions.

5-222. Data Collection and Instrumentation
Requirements for collection of data by instrumentation are a major part of many tests. Procedures must be developed which describe the requirements for instrumentation equipment and personnel (operators and maintainers) to ensure that adequate physical facilities are available and that appropriate personnel training is accomplished. It also describes how the complete instrumentation system will be tested and verified prior to, or as part of, the pilot test. This may include, in conjunction with other collection means, the planning and performance of an end-to-end data processing trial.

5-223. Logistics Requirements
The data collection cell identifies peculiar logistics support requirements to the test directorate describing any particular logistics requirements of the data collection section, especially transportation, communications, and rations.

Section XVIII
Test Data Reduction

5-224. General
The data reduction process consists of data processing through level 4. When practical, this process begins during the test execution phase (or as soon as raw data becomes available), rather than waiting until the test execution phase has been completed. This is necessary to ensure the highest degree of quality control at the earliest time when the data is fresh.

5-225. Data Reduction Plan
It is the responsibility of the test officer to ensure that data reduction is adequate to provide the data in a form that the analysts can use productively. A coherent data reduction plan showing how the data will be processed, transformed, and/or presented is vital to the test program. The plan should explain how the data can be scrutinized quickly for the post-mission briefings and how the data will be handled for more thorough analysis.

5-226. Data Reduction Methods
Data can be reduced in several ways, ranging from central processing with a high capacity computer, to manual extraction and correlation.

a. Generally, a central processor is required for automated instrumentation data such as that for position location. This data is read from hard disk or magnetic tape and presented on a high speed printer or displayed graphically from a CRT or plotter.

b. Manually collected data is usually compiled and sorted in matrix form. It can be entered by keyboard on a central processor for future integration into other data bases or entered on a personal computer for storage and/or limited manipulation.

c. Video and voice data, collected on tape, is replayed on a monitor with IRIG time or other key parameters superimposed on the screen. The analyst can reduce this data manually but many of the recorded parameters can be entered by keyboard on the central processor to be reformatted and become part of an overall data base.

d. Additional common techniques may be employed, but the important goal for the test officer is to recover the reduced data fast enough to enable the analyst to confirm its validity before too many missions have been completed.

e. Interim reduction consists of manual or automated procedures which transform data from the data collection means to the form required in the final data base.

f. Manual reduction includes processes requiring expert analyses and judgment such as extracting quantitative data from videotapes and examining data from multiple sources to resolve apparent contradictions.

g. When extensive manual reduction and validation is needed, a DAG may provide limited support. However, DAG autonomy and independence must be preserved by ensuring that the DAG does not participate in any of the required steps in the data reduction process.

h. Automation is used whenever it can sensibly replace manual reduction procedures, and such automation support is documented in the automation support plan.

5-227. Data Reduction Review

At the conclusion of the data reduction sub-phase, in-house personnel should review the data and the planned methodology for data analysis. Level 1 through 4 data should be available for this review to enable tracking of the data reduction process. At each step that data changes to a different level, quality control is critical. The newly ordered data must accurately and faithfully represent the test events that triggered it. Quality checks must be exercised during pilot test and periodically during record trials.

5-228. Data Turn-around

Data must be turned around as expeditiously as possible. Data entry and data reduction should not tolerate any backlogs. If data collection forms backup, quality control is difficult, because the trail is cold when errors are discovered. Expedited production of test data assists MATDEV pursuit of appropriate corrective actions, permits the test officer and evaluator to begin analysis and report generation, and allows time for discovery and investigation of anomalies while the test is still in progress. Slow turn-around of data reflects poorly on the competence of the test organization and the test director.

Section XIX
Test Data Quality Control

5-229. General

Quality control is the process for independently validating test data. It defines the checks and procedures which are to be used to preclude or detect and correct errors made in data collection, data entry, or data reduction. It also identifies emerging data summaries required to identify potential inconsistencies. It

outlines the process for making required corrections or changes in test data and how an audit trail for those corrections or changes is to be maintained.

5-230. Data Verification
Data verification determines whether the data correctly represent the variables they characterize, and whether the data collected are adequate to support the OTE reports. Specify requirements for and techniques proposed for data verification. Data collection procedures are to be validated prior to starting the test and checked during the test to ensure that critical data are being accurately collected. Expedited data turn-around procedures are necessary to assure that quality control checks are timely. This permits reconstruction of erroneous, conflicting, confused, or incomplete data while collectors and participants memories are still fresh.

5-231. Quality Control Procedures
The data management officer must develop in detail the data management procedures which ensure that the correct data are collected and that the data collected are correctly portrayed. Data management quality control procedures provide mechanisms for adding or changing data requirements and for modifying data collection or reduction procedures based on examination of emerging test data. This differs from the quality control procedures in data collection which are generally limited to assuring that data are completely and accurately collected.

5-232. Quality Control Checks
Both manual and automated checks are used to ensure that data are correctly entered and portray test events accurately. Although manual checks often include extensive review of computer printouts, they should not generally involve extensive arithmetic operations. Such operations, together with repetitive logical checks, should be automated to the maximum extent and documented in the data reduction plan. Manual checks consist primarily of checks which cannot be easily automated (such as review of graphical displays) and assessment of related data from several sources for overall consistency.

5-233. Quality Control Limitations
The data management responsibility is to ensure that data taken as a whole represent what actually happened during the test. It stops short of evaluative analyses of test data, which are primarily concerned with the interpretation and significance of test data within the broader framework of a system evaluation.

5-234. Trial Validation

a. The validation process describes the procedures (and organization if appropriate) for determining the acceptability of trial conduct and validity of trial results prior to data reduction. The process of validating trials shortly after their conduct leads to timely recognition of invalid trials, timely rescheduling of trials which fail to meet minimum standards and efficiency in data reduction because invalid data is segregated before processing.

b. Decisions on trial validity are to be made by the test officer with input from blue and red forces command, instrumentation, and test control spokespersons. DAG personnel may be involved in the validation process as appropriate (eg, provide technical expertise, etc.), but may not participate or vote in it.

Section XX
OTE Data Bases

5-235. Data base design
The data base design is the process whereby the structure and content of the data base for storage of the test data is formulated, created, and documented. The architecture and design of the data base are described including the relationships among files and records. The data in each file or record are to be listed and augmented by any necessary definitions. Good data definitions specify exactly what is measured when. Examples are:

a. "Elapsed time to transmit a call is to be measured and recorded to the nearest second by a data collector at the transmitter using a stopwatch. Transmission time begins when the operator . . . <specify operator action> and ends when . . . <specify operation>."

b. "RMS display range is the RMS range between the aircraft and the ground target at the time when the 1553 data bus in the aircraft confirms that the ground target symbol is displayed on the aircraft gunner's scope. This is available from the RMS instrumentation system."

5-236. Data Base Preparation
When test data are extensive enough to require storage in an automated data base, the structure and content of the data base are prepared in accordance with the architecture and design of the data base established during test planning. The data management section ensures that test data is entered into the

data base in accordance with the preplanned relationships among files and records.

5-237. Management of the Data Base
Data base management describes the procedures to ensure integrity of the test data base. In particular, it specifies data entry and updating procedures which preclude transcription errors and unauthorized access and provides for a complete audit trail for the data.

5-238. Data Base Report
The data base structure and data dictionary (listing and description of all codes used in the data base) become the core of the Data Base Description (Appendix A of the TER or TR).

Section XXI
DAG Operations

5-239. DAG Purpose
The DAG authenticates and validates the test data, ensuring that test data accurately reflect the system performance during the test and provide the single test database of record (the ground truth) for all users of the test data. The DAG identifies and analyzes anomalies in the system under test, instrumentation, and test data. The DAG provides interested agencies a conduit to express opinions during test planning and execution.

5-240. Establishment of the DAG
The IOE establishes the requirements for a DAG on full-evaluate system tests. These requirements are documented in the TEP. If the IOE does not require a DAG, the tester determine if a need exists and establishes a DAG. The tester determines if a need exists and establishes a DAG for an abbreviated evaluate systems and for FDTE, CEP, and CT.

5-241. DAG Roles and Missions

a. The DAG serves the function of bringing together the interested parties on an operational test and allowing these parties to view test planning, execution, and data reduction. DAG members provide recommendations to the evaluator and tester on matters of test design, test conduct, and test data reduction. It provides a level of quality assurance above that expected from the data management quality control function. The DAG acts as advisory group to the Test Director and the Chief Evaluator.

b. Due to the variations in development systems, evaluation strategies, test designs, and data collection efforts, the duties of each DAG are specifically tailored to accommodate the unique requirements of the test. The evaluator and the tester carefully define the relationship between the DAG and the other elements of the test directorate.

c. The DAG acts independently of the data management and quality control process and does not work under the supervision of the data manager. It provides a level of quality assurance above that to be expected from the data management quality control function.

d. DAG members will review and authenticate the test conduct, data collection, data reduction and data base contents as indicated by the SOP. The DAG will identify and investigate any problems, discrepancies, or anomalies found in these areas, and make recommendations to the Test Director for resolution of these problems. The DAG verifies that the data contained in performance, human factors, and RAM test data bases are valid test results. The DAG will publish reports as required. The DAG serves to promote T&E community understanding and acceptance of the operational test data.

e. Final decisions on test design, test conduct, and test data reduction, lie solely with the tester and evaluator.

5-242. DAG Membership

a. The IOE chairs the DAG for full-evaluate system tests. The tester chairs the DAG (when established) for all other tests.

b. The DAG charter establishes DAG membership. Mandatory members are the evaluator and tester. Select other members from the Combat Developer, Materiel Developer, Technical Evaluator, Technical Tester, and other members of the acquisition team. Extend membership to any pertinent government agency (DOTE, AAA, GAO) with a vested interest in the system under test. The members of the DAG represent a broad spectrum of technical disciplines and system expertise.

c. Each DAG is organized to accommodate the unique requirements of the test. Large DAGs are typically organized into various functional teams such as a performance validation team, a MANPRINT data validation team, a RAM data validation team, and a research cell. Small DAGs may consist of one cell.

d. The law (10 USC 2366) prohibits direct participation in the DAG by system contractors. The DAG permits no system

contractor manipulation or influence during IOT and other activities which provide input for consideration during beyond LRIP decisions for ACAT I and II systems. System contractor personnel will not attend or be directly involved as members or observers in any DAG sessions.

e. Support contractors to DAG members may participate in the DAG if they have never had a contractual relationship to the system contractor on the system under test.

5-243. DAG Resources
All resources for the functions of the DAG must be included in the OTP for the test. Resources for personnel, travel, equipment, facilities, and overtime, must be estimated by the tester, with input from the IOE.

5-244. DAG Training
The DAG cannot function properly if the members do not have adequate training. Training should be addressed in the DAG SOP and, as a minimum, members should have training in operations and capabilities of the system under test, familiarization with test purpose and concept as documented in the TEP and DTP, the data reduction plan and instrumentation for the test, the DAG SOP, and test organization and key personnel.

5-245. Data Levels

a. The originator of the requirement for the DAG determines the data levels to be reviewed by the DAG and addresses this in the DAG SOP. Each member of the DAG should be clear on the meanings of each data level as given in Figure 5-12.

(INSERT FIGURE 5-12)

b. The DAG SOP may call for examination of data from levels 1-3 in the authentication process. Once the level 3 data base has been reviewed and approved by the DAG, it becomes the authenticated data base, which is the database of record for that test. Authenticated data are releasable to members of the acquisition team.

c. The analysts can reduce and analyze these data into findings and assessments (levels 4, 5, 6, and 7). The levels of data and their relationship to the reduction and analysis process and the categories of test results are illustrated in Figure 5-12.

Section XXII

Test Data Analysis Process

5-246. General
Data analysis consists of performing those analytical techniques defined in the TEP and further amplified in data reduction and analysis planning. Normally this phase involves the use of inferential statistics and the application of logic, common sense, and military judgment to data of levels 3 through 6 for the purpose of identifying findings and making assessments and evaluations.

5-247. Evaluation Plan or Analysis Plan

a. Essentially, the correct analytical approach starts with the evaluation/analysis dendritic, the MOE/MOP list, and the Data Requirements list. The lists correlate (through the dendritic) to each criterion and, thence, to each issue.

b. The Evaluation Plan (Analysis) plan in Chapter 2 of the TEP states how the collected and reduced data relating to each MOE/MOP will be used to answer the respective criteria and how all the answered criteria will address the issues.

c. The plan also addresses the sample size and confidence level for any measured parameters (e.g., operational availability (A_O) for any hypothesis testing required as part of a MOP. The adjustments to sample sizes are a vital part of the test program because they directly affect cost and resources.

d. The plan is dynamic in the respect that it may require continuous updating during test execution as a function of any unforeseen events that affect the validity of the data base. The tester, evaluator, and analysts must periodically review the adequacy of the plan to ensure that it will properly answer all of the questions for each issue and criteria.

e. Review and analysis of the data will often lead analysts to investigate analytic procedures not envisioned in the plan. Emerging results may often suggest new approaches. The tester and evaluator have the latitude to perform these investigations so long as they are documented in the report.

5-248. Data Analysis Techniques/Procedures
Data analysis techniques or procedures formulate a subject of great extent and complexity. They range from the logical qualitative approach, such as orderly arrangement of test incident reports (Terse), to curve fitting of probability density and distribution functions by regression methods. Many of these

techniques are usually an analytical or engineering specialty, but the evaluator, tester, and analysts should have a basic understanding of how they are used. Choose analytical personnel for the OT&E team whose background is compatible with the level of difficulty involved in required data analyses.

5-249. Analytic Review Board

After the data has been analyzed and findings, assessments, and accompanying discussion have been formulated, an analytic review board may be held to review results prior to writing the report. The board would give appropriate personnel an opportunity to review the analytic work and question the logic or techniques which resulted in findings and assessments. Format for this review should be the question and answer type, and require no formal presentation.

5-250. Data Base Formats

As the manipulation of test data becomes more and more sophisticated, it is essential that some type of data base format be established. However, because of the diversity of the data and the various techniques that can be used to manipulate the data, it is difficult to use only one format for all data reduction. Use a common data software packages for analysis (i.e., SAS, DBase III or IV, Lotus 1-2-3). Unless otherwise approved, use one of these formats when formatting a data base. Data displays will be as specified in the TEP.

Section XXIII
Test Data Reporting

5-251. General

This process identifies data display requirements and anticipated displays (both management displays and report displays). Management displays summarize the status of the test or test events. Report displays present (or in special cases summarize) test data. Display requirements specify how the data are to be organized, formatted, and displayed.

5-252. Test Management Displays

Management display procedures describe any data listings, tabular summaries, and graphical displays to be used to monitor and control test conduct, and assure data quality. Two examples of such displays are: tables of conditions associated with test events conducted (for comparison with controller records) and lists of sorted data (to identify possibly anomalous data for detailed review).

5-253. Report Displays

a. Report displays (tester and evaluator) present (or in special cases summarize) test data. Specifications for each report include the data to be displayed, the factors and conditions by which they are to be organized, the selection criteria for determining whether a data point is to be included, and guidance as to the form of the display.

b. Summary statistics or graphs are used in test report displays only for large sets of data (more than can reasonably be displayed on one page) and in these cases, selection criteria and reference to the data base are to be identified.

c. Data presentations are not to include any judgments or evaluative treatment by the tester. Judgmental information, such as test directorate, user, or expert observer opinions, are to be explicitly identified as such and presented as derived in a separate display. The tester does not decide among disagreements or take responsibility for the correctness of judgmental data.

d. Good data displays do not lead the reader to any conclusions concerning the presented test data. For this reason, the best test report displays are tabular.

5-254. Procedures for Release of Data

a. The test directorate, in accordance with established policy, describes procedures for access to data and for release of interim data outside the test and evaluation teams. Access to test data is generally granted IAW AR 25-55, The Department of Army Freedom of Information Act Program, 10 January 1990.

b. All data is releasable to the tester and the evaluator. Authenticated test data may be released to the acquisition team members, HQDA staff, and to DOTE based on need-to-know and security considerations. However, release of interim data is generally discouraged.

c. Any release (including reports from test and evaluation team members to superiors outside the test directorate) is to be dated and is to clearly indicate the preliminary nature of the data.

SECTION XXIV
Completion of Test

5-255. Official Completion Date

The test is officially completed at the scheduled completion date unless unforeseen difficulties have precluded collection of all required, analyzable data. Proper conduct of the test will enable the test officer to make the final decision regarding acceptable test data. If the collected data in the final missions of the test program are not acceptable, the procedure for extending the test as discussed in ????????? will be followed.

5-256. Post Test Activities

a. The test officer must remain on the test site or revisit the site as necessary to phase out all operations. The equipment under test and all other external resources must be returned to their normal places. The test area should be policed to clear out litter and other expendable items. Care must be taken to ensure that personnel, anxious to return to their normal duty stations, do not allow lapses in security to occur or to neglect necessary close-out duties.

b. All test and player personnel must acknowledge completion of their assigned duties before release. A list of all these persons and their addresses should be retained to provide appropriate written recognition of their efforts. Any test event causing a potential adverse effect on the environment should be reported to senior directorate personnel and appropriate post agencies.

SECTION XXV
Special Considerations

5-257. Contractor Relations

a. The intent of Section 910, Subsection 2366, paragraph (b)(2) of Public Law 99-661 is to ensure that, during OT, major weapon systems are operated, maintained, and otherwise supported by personnel typical of those who will carry out such duties when the system is deployed in combat. Therefore, this paragraph will be applied to the test and evaluation of ACAT I programs and is recommended for application to the test and evaluation of all programs (See AR 73-1).

b. To ensure there is no system contractor manipulation and/or influence during IOTE or activities which provide input for consideration in the operational evaluation leading to a full production decision for ACAT I programs:

(1) System contractor personnel will not:

(a) Participate except to the extent they are involved in the operation, maintenance, and other support of the system when it is deployed.

(b) Participate in collection, reduction, processing, authentication, scoring, assessing, analysis, or evaluation of operational test data.

(c) Attend or be directly involved as members or observers in OT DAG sessions (see above in this chapter) or in RAM scoring or assessment conferences (see Part One) which address test data supporting operational evaluation or assessment of their systems.

(2) Discussions with system contractor personnel may be necessary to ensure full technical understanding of observed test incidents during the above IOTE or activities. Each and every such discussion will be held separate from any scoring/assessment activities. A written record of the nature of these contractor to government discussions will be maintained by the test officer or independent evaluator, as appropriate.

c. Since some systems will be maintained by contractors after fielding, it is imperative that any contractor effort be defined in writing prior to T-date. Ideally, any authorized contractor maintenance would be specified by level and extent in each of the appropriate test support packages. Contractor efforts should be an agenda item briefed at the T-60 OTRR, and agreed to by all parties. EUTE and FDTE prior to IOTE will often require a greater amount of contractor maintenance support, but this must be worked out in the TIWG.

d. Although the above legal strictures apply only to ACAT I systems during IOTE or any FOTE leading to a beyond LRIP, full production decision, it is DA policy that these strictures should apply to all OT of materiel and IMA systems.

5-258. Release of Test Information

a. Release of OT data to members of the acquisition team (MATDEV, CBTDEV, TNGDEV, development and operational evaluators, and development and operational testers is authorized as soon as the data are authenticated (Level 3 data). Release is also authorized to TEMA, ODUSA(OR), and DOTE. The operational tester is authorized to release these data.

b. Release of OT data beyond the acquisition team will be accomplished only with the approval of CG, OPTEC or the commander of other OTE activities. All such requests for data should go to

the evaluator who will then coordinate with the tester and the PEO or PM.

c. The conduct of operational tests on new materiel has gained widespread interest, resulting in numerous requests for interim OTE data. These requests are generated by congressional survey and investigatory committees, the General Accounting Office (GAO), the Army Audit Agency (AAA), industry, contractors, and private individuals.

d. Any requests for test information received by the test team from members of news media or civic organizations should be reported immediately to the appropriate agency public affairs officer.

e. The test officer's primary mission is the conduct of the test. All requests from outside the acquisition team for interim data or reports should first be coordinated with the program manager (PM) or program executive officer (PEO). Requests for information from private industry or individuals will be processed as public information releases or Freedom of Information Act (FOIA) requests. Directives addressing the release of information must be used for guidance. (See AR 1-20, AR 25-55 and AR 360-5.)

f. Release of draft or interim test reports, evaluations, or assessments is discouraged. Assessments made prior to the complete analysis of test results can be very misleading, can be found to be incorrect when the complete set of test data is thoroughly analyzed, and can cause biases which are difficult to overcome even when further information proves them incorrect.

g. Release of interim data or reports will not be made without:

(1) Verification of the requester's identity and need.

(2) Analysis of the difficulty associated with providing the information requested.

(3) Coordination with OPTEC or other operational test activity staff.

h. All data released will be as authentic and complete as possible. The data or report will be clearly marked as interim and cautions to be considered in its utilization will also be stated.

i. Copies of the release letter will be retained in the official system file.

j. Release of information to system contractors will be made only through the PEO, PM, or appropriate materiel developer representative. Release of information to support contractors will be made only through the COR or COTR.

k. Security classification and procedures to protect classified or competition sensitive information will always be observed.

Detailed Test Plan
for
(Name of Test)

1. Purpose. (Repeat paragraph 1.1 from TEP.)

2. Scope. (Repeat paragraph 1.2 from TEP.)

3. Background. (Repeat paragraph 1.3 from TEP.)

4. System description. (Repeat paragraph 1.4 from TEP.)

5. Critical operation issues and criteria (COIC) or operational issues and criteria (OIC). (Repeat paragraph 1.7 from TEP.)

6. Test and evaluation milestones. (Repeat paragraph 1.6 from the TEP, as modified by any subsequent changes since TEP approval.)

7. Changes to TEP chapters 1, 2, and 3.

7.1 List substantive changes to paragraphs contained in chapters 1, 2 and 3 of the approved TEP. Changes should be in the form of replacement paragraphs, as appropriate. Each change should be formatted as follows:

"7.1 Change to TEP paragraph x.x.x:

X.X.X Enter the changed paragraph, to include subparagraphs, tables, and figures as appropriate."

7.2 Change to TEP paragraph y.y.y

Y.Y.Y Changed paragraph."

8. Summary of DTP appendix contents. General description of the changes, modifications, or additions to the approved TEP that is contained in the DTP. The format should be general subparagraphs that summarize the material. Examples are:

a. Data Management Plan (app K). If no other change is necessary this may simply amount to adding the final data collection forms for the test. The data collection forms were not developed for inclusion in the TEP.

Figure 5-1. Format for DTP

b. Control Plan. If this appendix remains substantially correct then all that may need to be added is the final organization of the control section or a description of a new radio or wire net for test control.

c. Training Plan. There may have been a change in the location of instruction or instructors which needs to be described.

d. If an appendix is not changed from the corresponding appendix contained in the approved TEP and is not included in the DTP, indicate by adding the words "(Not changed)" following the appendix listing. For example:

Appendix U. Glossary (not changed).

e. If an appendix is simply not used, so state. For example:

Appendix L. Instrumentation, Targets, and Threat Simulators Support Plan. (Not used).

(NOTE: Include each of the following appendixes, as appropriate, which are needed and which have been changed from the appendixes contained in the approved TEP. Appendix identification letters should correspond with the appendix letters used in the approved TEP. Do not reprint or include approved TEP appendixes which have not been changed. List all appendixes and indicate those not used in accordance with the note following the listing.)

APPENDIXES:

APPENDIX A. Supporting Documentation
APPENDIX B. Background--OPTIONAL
APPENDIX C. System Description--OPTIONAL
APPENDIX D. Projected Threat--OPTIONAL
APPENDIX E. DAG Charter and SOP--Required if DAG is called for in paragraph 2.4.5. of the TEP
APPENDIX F. Outline Test Plan (OTP)
APPENDIX G. Pattern of Analysis
APPENDIX H. Test Scenarios--OPTIONAL
APPENDIX I. Test Threat--OPTIONAL
APPENDIX J. Control Concept
APPENDIX K. Data Management Plan
APPENDIX L. ITTS Support Plan
APPENDIX M. Audiovisual Support Plan
APPENDIX N. Automation Support Plan
APPENDIX O. Training Plan
APPENDIX P. Test Support Plan

Figure 5-1 (cont). Format for DTP

APPENDIX Q. Test Environmental Assessment
APPENDIX R. Environmental Impact Statement
APPENDIX S. DOT&E Test Concept Approval
APPENDIX T Test Change Proposals
    TAB 1. Test Change Proposal #1
        Through
    TAB n. Test Change Proposal #n
APPENDIX U. Glossary, Acronyms, and Abbreviations
APPENDIX V. TEP Coordination Record
APPENDIX W. Authors and Supporting Personnel
APPENDIX X. TEP Distribution List

Figure 5-1 (cont). Format for DTP

STRAWMAN
DATA AUTHENTICATION GROUP (DAG)
STANDARD OPERATING PROCEDURES (SOP)

1. Purpose. This SOP describes the DAG operation specific to this test. It includes the mission, concept of operation, organization, responsibilities, and expected output.

2. Mission. This paragraph describes the mission of the DAG. It should be tailored to the needs of the test, and identify the actions to be performed by the DAG. These may include functions such as review of data reduction procedures, review of data to verify that the contents of the database reflect the events of the test, witness of trial conduct to verify compliance with the test plan, problem investigation and recommendation of solutions, and expected DAG output such as reports. Specific levels of data to undergo DAG review should be identified.

3. Concept of Operation. This paragraph provides the procedures of the DAG and its relationship to the rest of the Test Directorate. It should describe the DAG's interaction with the Data Manager at each level of data review. One approach would be to chart the flow of the data to be reviewed as it comes from the data manager to the DAG and goes back to the Data Manager, indicating each level to be reviewed. The process for validating the data and the methodology proposed for tracking data that has been validated should be documented. This paragraph should specify the term of the DAG (e.g., T-date through C-date plus 60), the frequency of data deliveries to the DAG for review, the frequency of DAG meetings, and what is required to declare the database "authenticated"; i.e., what will constitute completion of the DAG mission. This paragraph should also contain the reporting chain from the DAG chair to the Test Director.

4. Organization. This paragraph provides the organization structure and membership of the DAG itself. Members may be formed into teams responsible for specific DAG functions. Special teams may be formed as needed to research problems identified by the DAG. These research teams may include non-DAG members who provide a technical expertise needed to complete the investigation. System contractor personnel may be part of a research team, but may not attend or otherwise participate in the DAG meetings.

Figure 5-2. Strawman DAG SOP

5. Responsibilities. This paragraph defines the duties any DAG member must perform to contribute to the goal of DAG mission accomplishment, including the minimal requirement for regular attendance. It also should identify the duties of the DAG chair to organize the DAG and implement the SOP, including the interface between the chair and the rest of the Test Directorate. If the DAG is organized into teams, the responsibilities of team leaders to organize their teams, assure completion of the team function and provide regular status reports to the DAG chair should be listed. The party responsible for development and conduct of DAG training should be identified.

6. Training. This paragraph addresses the contents and schedule of the DAG training program.

7. Reports. This paragraph addresses the expected products of the DAG including timing, approval chain, and release authority.

Figure 5-2. Strawman DAG SOP (cont)

FORMAT FOR A TEST CONTROL PLAN

THE TEST CONTROL PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

1. CONTROL CONCEPT.
   1.1. Purpose.
   1.2. Scope.
   1.3. Approach.
   1.4. Level of Operational Realism.
   1.5. Synopsis of Events.
   1.6. Control Methods.
2. PROGRAM OF EVENTS.
   2.1. Test Outline.
   2.2. Detailed Test Schedule.
   2.3. Overall Test Scenario.
   2.4. Detailed Test Scenario.
   2.5. Event Summary.
   2.6. Scenario Revision and Documentation.
   2.7. Pilot Test
3. CONTROL PROCEDURES.
4. DOCUMENTATION.
   4.1. Controller Logs.
   4.2. Test Status Reporting.
   4.3. Historical Documents.
   4.4. Submission Schedules.
5. CASUALTY ASSESSMENT.
6. CONTROL ORGANIZATION.
   6.1. Organization Chart.
   6.2. Control Section.
   6.3. Control Teams
   6.4. Communications Control
   6.5. Test Operations Center

Figure 5-3. Format for a Test Control Plan

FORMAT FOR A DATA MANAGMENT PLAN

THE DATA MANAGMENT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

1. Data Management Concept.
   1.1. Organization.
   1.2. Data Flows.
   1.3. Methods of Operation.
2. Data Collection Procedures.
   2.1. Collection Methods.
      2.1.1. Manual Recording by Players.
      2.1.2. Manual Recording by Data Collectors.
      2.1.3. Automated Collection by Instrumentation
      2.1.4. Questionnaires.
      2.1.5. Data Collection Forms.
      2.1.6. Structured Interviews.
   2.2. Collection Support.
      2.2.1. Initial QC Procedures.
      2.2.2. Debriefing Procedures.
      2.2.3. Instrumentation.
      2.2.4. Data Collectors with Special Qualifications.
      2.2.5. Data Security Requirements
      2.2.6. Special Data Handling Requirements.
      2.2.7. Video and Photography Documentation.
3. Data Reduction Procedures.
   3.1. Data Entry
      3.1.1. Manual.
      3.1.2. Automated.
   3.2. Data Processing.
   3.3. Data Verification/Validation.
   3.4. Data Storage.
   3.5. Data Manipulation.
   3.6. Data Presentation.
4. Data Base Design.
   4.1. Identification of the Required Files.
   4.2. Data Base Architecture.
   4.3. Definition of Data Elements.
   4.4. Data Inputs and Outputs
      a. Data name
      b. System name
      c. Width (char)
      d. Format
      e. Edit checks
      f. Source

Figure 5-4. Format for a Data Management Plan

FORMAT FOR A DATA MANAGMENT PLAN

THE DATA MANAGMENT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

5. Data Base Structure.
  5.1. Data Element Dictionary.
    a. Data name
    b. System name
    c. Data description
    d. Range of the data
    e. Data source
  5.2. Sample Forms.
  5.3. Data Base Management.
6. Quality Control (QC).
  6.1. Manual QC Checks.
  6.2. Automated QC Checks.
  6.3. Data summaries.
  6.4. Audit Trails.
7. Output Reports.
  7.1. Test Report.
  7.2. Data Displays.
  7.3. DAG Reports.
  7.4. Quality Control Reports.
  7.5. Scoring Conference Reports.
  7.6. Test Incident Reports.

Figure 5-4. Format for a Data Management Plan (cont)

FOMAT FOR AN ITTS SUPPORT PLAN (ISP)

ITTS SUPPORT PLAN FOR THE <XXXX> TEST FOR THE <YYYY> SYSTEM

1. ITTS Support Concept.
1.1. Purpose.
1.2. Scope.
1.3. Approach.
1.4. Brief System Description.
2. Instrumented Data Collection.
2.1. Data Requirements.
2.2. Collection Considerations.
2.2.1. Goal.
2.2.2. Redundancy.
2.2.3. Movement.
2.2.4. Additional Equipment.
3. Interface with ADP.
4. ITTS Requirements.
4.1. Nummber and Type of Evaluated Systems.
4.2. Data Inputs.
4.3. Mobility.
4.4. Scenarios.
4.5. Security.
4.6. Power Sources.
4.7. Collection Locations.
4.8. Soldier Monitoring.
4.9. Candidate Systems.
5. Other Support Requirements.
6. Test Support.
6.1. Milestones.
6.2. Demonstrations.
6.3. Training.
6.4. Pilot Test.
6.5. OTRR.
7. Conduct of Test.
8. Special Instrumentation Considerations.

Figure 5-5. Format for an ISP

FORMAT FOR AN AUDIOVISUAL SUPPORT PLAN (AVSP)

THE AUDIOVISUAL SUPPORT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

1. AUDIOVISUAL CONCEPT.
   1.1. Purpose.
   1.2. Scope.
   1.3. Approach.
   1.4. Support Description.
      1.4.1. Significant Events.
         1.4.1.1. Detectability.
         1.4.1.2. Tactical Mobility.
         1.4.1.3. Engagement Sequences.
         1.4.1.4. MANPRINT.
         1.4.1.5. Still Layouts.
         1.4.1.6. Targets.
      1.4.2. Personnel and Training.
      1.4.3. Procedures.
2. OPERATIONAL REQUIREMENTS.
   2.1. Equipment.
      2.1.1. Video.
      2.1.2. Still.
   2.2. Subject Areas for Support.
      2.2.1. <name> (1st Subject Area for Support).
         2.2.1.1. Type of support required.
         2.2.1.2. Quantity.
         2.2.1.3. Location.
         2.2.1.4. Plan.
      2.2.2. <name> (2nd Subject Area for Support).
         (through)
      2.2.n. <name> (n-th Subject Area for Support).
3. SCHEDULING.
   3.1. Pretest.
   3.2. Pilot Test.
   3.3. Conduct of Test.
4. SPECIAL REQUIREMENTS AND CONTINUOUS COVERAGE.
   4.1. Non-Standard Tests.
   4.2. Limited Resources.
   4.3. Support Requirements.
   4.4. Contingencies.
      4.4.1. Equipment Failure.
      4.4.2. Changing Requirements.

Figure 5-6. Format for an AVSP

FORMAT FOR AN AUTOMATION SUPPORT PLAN (ASP)

THE AUTOMATION SUPPORT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

1. ADP Support Concept.
  1.1. Organization.
  1.2. Data Flow and Anticipated Volume of Data.
  1.3. Method of Operation.
    1.3.1. Equipment or Services.
    1.3.2. System or Software.
2. Design Details.
  2.1. ADP Functional Description.
  2.2. Detailed Characteristics.
    2.2.1. Performance Requirements.
      2.2.1.1. Accuracy.
      2.2.1.2. Timing.
      2.2.1.3. Inputs and Outputs.
        a. Data name.
        b. System name.
        c. Width (char).
        d. Format.
        e. Edit checks.
        f. Source.
    2.2.2. Failure Contingencies.
      2.2.2.1. Backup.
      2.2.2.2. Fallback.
  2.3. Data Entry.
    2.3.1. Manual.
    2.3.2. Automated.
  2.4. Data Processing.
  2.5. Data Verification/Validation.
  2.6. Quality Control.
  2.7. Storage.
  2.8. Data Manipulation.
  2.9. Output Reports.
    2.9.1. Test Report.
    2.9.2. Data Displays.
    2.9.3. Other Preliminary Reports.
  2.10. Analysis Requirements.
  2.11. External Interfaces.
3. Data Base Structure.
  3.1. Dictionary.
  3.2. Sample Forms.
  3.3. Output Reports.

Figure 5-7. Format for an ASP

FORMAT FOR AN AUTOMATION SUPPORT PLAN (ASP)

THE AUTOMATION SUPPORT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

4. Environment.
   4.1. Hardware.
   4.2. Communications.
   4.3. Facilities.
   4.4. Cost.
5. System Development.
   5.1. Software Development.
   5.2. User's Manual.
   5.3. Coordination.
   5.4. Training.
6. Test Support.
   6.1. Milestones.
   6.2. Demonstrations.
   6.3. Training.
   6.4. Pilot Test.
   6.5. OTRR.
   6.6. Control and Retention of Data Base.

Figure 5-7. Format for an ASP (cont)

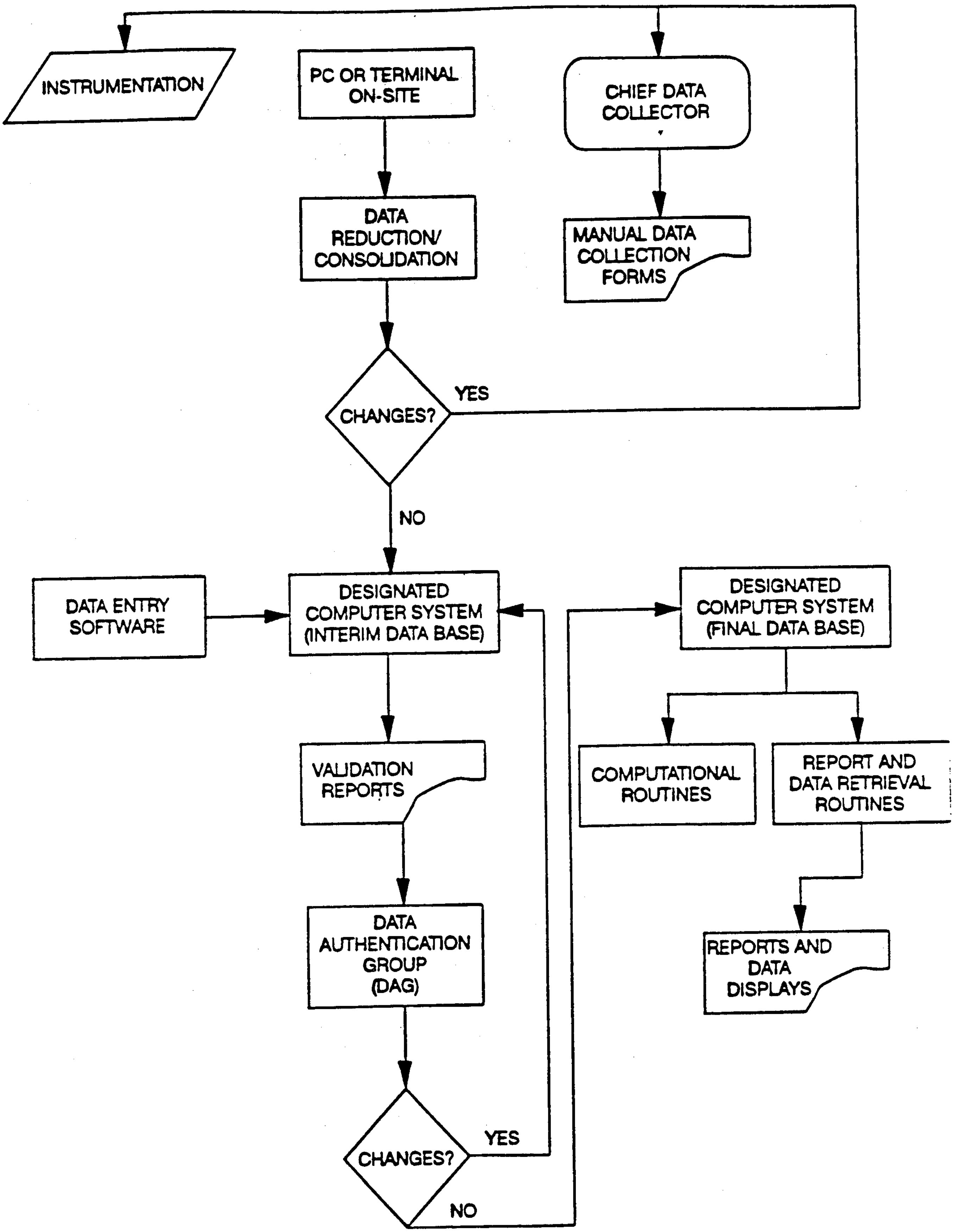


Figure 5-8. Example flow of data for ADP.

FORMAT FOR AN TEST SUPPORT PLAN (TSP)

THE TEST SUPPORT PLAN FOR THE <XXXX> TEST OF THE <YYYY> SYSTEM

1. Test Support Concept.
  - 1.1. Purpose.
  - 1.2. Scope.
  - 1.3. Approach to Test Support.
  - 1.4. Organization for Test Support

2. Logistics Support.
  - 2.1. Supply.
  - 2.2. Maintnenace.
  - 2.3. Transportation.
  - 2.4. Facilities.
  - 2.5. Services.
  - 2.6. Medical.

3. Administrative Support.
  - 3.1. Communications
    - 3.1.1. Radio.
    - 3.1.2. Wire.
  - 3.2. Detailed Cost Estimate.
  - 3.3. Safety.
  - 3.4. Electronic Warfare.
  - 3.5. Visitor Control.
  - 3.6. Public Affairs.
  - 3.7. OPSEC.
  - 3.8. Security.

4. Long Lead Items.
  - 4.1. Ammunition.
  - 4.2. Aircraft.
  - 4.3. Instrumentation.
  - 4.4. Personnel Skills.
  - 4.5. Equipment Fabrication.
  - 4.6. Contracts.
  - 4.7. Environment.
  - 4.8. Target Alteration.
  - 4.9. Permanent Construction.
  - 4.10. Electrical Power.
  - 4.11. Liquid Petroleum Gas/Water/Septic Tanks.
  - 4.12. Nonstandard Stock.
  - 4.13. Rental Car Support.
  - 4.14. Telephone/FAX Lines/Radios (Communications).
  - 4.15. Computer Support.

5. Test Support Schedule.

Figure 5-9. Format for an TSP

OTRR AGENDA

1. <u>Purpose</u>

2. <u>Program Sponsor Issues</u> (Program Sponsor)

   a. Results of Previous Testing

   b. System Equipment Status

   c. Operational Test Readiness Statement

   d. Safety Release

   e. System Delivery Schedules (Milestone)

   f. Contractors Support

   g. Logistics Support Plan

   h. Instrumentation

   i. System Transfer Plan

   j. Certification of Systems Readiness for OT

   k. Other Special Topics

3. <u>Combat Developer/Trainer Issues</u> (Combat Developer/Trainer)

   a. Test Soldier Training Results

   b. Operational Test Readiness Statement

   c. Safety Release

   d. Logistic Concept

   e. Operational Mode Summary/Mission Profile

   f. Threat

   g. Test Setting

   h. Certification for System Readiness for OT

   i. Other Special Topics

Figure 5-10. Sample OTRR agenda

4. <u>Test Readiness</u> (Operational Tester)

a. Test Directorate Organization (Mandatory). Description of the overall test organization and structure for the test.

b. OTP Resources/FORSCOM Support (Mandatory). Status of support required/received or coordinated in accordance with OTP.

c. Test and Evaluation Plan/Detailed Test Plan (Mandatory). Overview of the test design to include issues and criteria as appropriate and status of TEP development.

d. Test Schedule (Mandatory)

e. Participation/Other Agencies

f. Pilot Test (Plan or Result) (Mandatory). Description of planning pilot test activities or results of the pilot test.

g. Data Displays

h. Data Collection Reduction and Processing Plan

i. Test Instrumentation Status

j. ADATS

k. Test Site Support Plan

l. Human factors

m. Status of MOUs

n. Other Special Topics

5. <u>Overall Readiness</u> (Operational Evaluator)

a. Evaluator Critique of System Readiness

b. Evaluator Critique of Tactics, Techniques, and Doctrine

c. Evaluator Critique of Threat

d. Evaluator Critique of Training Readiness

Figure 5-10. Sample OTRR agenda (cont)

e. Evaluator Critique of Test Readiness

f. TEP Status

g. Overall Evaluation

6. DAG Composition and Operation (Operational Tester)

7. ADP Plan (Operational Tester)

8. Funding (Operational Tester)

9. Identification and Review of Showstoppers or Potential Showstoppers (Operational Tester and Evaluator)

10. Review of Action Items (Operational Tester)

11. Discussion (All)

12. Decision (Chairman)

Figure 5-10. Sample OTRR agenda (cont)

TEST EXECUTION CHECKLIST

1. Prior to movement to the field test site, the test officer must ensure the following items are on hand:

a. Test item.

b. Safety release. Ensure that a hard copy of safety release is in place prior to the start of any test. Verbal (telephonic) release in advance of a hard copy is unacceptable.

c. Combat developer's operational test readiness statement (OTRS).

d. Materiel developer's OTRS.

e. Training developer's OTRS.

f. Complete system support package.

g. Sufficient copies of data collection and data reduction forms.

2. Test site activities:

a. Ensure test support contractor sets up support site in accordance with test support plan.

b. Establish a field test operation center (FTOC).

(1) Establish access roster of essential personnel who can enter FTOC.

(2) Maintain a daily log of activities in FTOC for the pilot test and the test.

(3) Provide parent test directorate with a daily activities report at the end of each test day.

(4) Always have someone knowledgeable at FTOC during testing activities.

(5) Ensure FTOC area is policed, and when clearing area leave it better than you found it.

Figure 5-11. Test execution checklist

c. Establish a facility (porta-kamp or tent) to conduct briefings and pretest training and to administer questionnaires.

d. Establish a facility with telephone for the developers and proponent (limit their access to field test location without escort).

e. Establish a data collection-data reduction facility.

(1) Establish access roster of essential personnel who can enter data collection-data reduction facility.

(2) Maintain continuous quality control of data and if data collection is not done right ensure that event is done again.

f. Ensure that video documentary script outline is adhered to in getting video and photographic coverage of test.

3. Pretest activities.

a. Final coordination with test support unit will include the following actions:

(1) Organize test support.

(2) Coordinate movement of unit to field test site.

(3) Establish rapport with test unit commander and his parent organization.

b. Prepare test equipment for testing.

c. Prepare visitor's briefing.

d. Set up instrumentation and/or special equipment and ensure it is operational.

e. Conduct training for players (both individual and unit), data collectors-reducers, and controllers-evaluators.

f. Conduct vehicle safety class and establish test support vehicles control procedures.

g. Conduct overall safety class.

4. Pilot test to exercise the following requirements of the test:

Figure 5-11 (cont). Test execution checklist

a. Instrumentation.

b. Control procedures.

c. Data collection.

d. Data reduction.

e. Players.

f. Test support.

g. Scenario.

5. Conduct pilot test in-process review and corrective action.

6. Test.

a. Collect data.

b. Start data reduction.

c. Start data input into computer.

d. Report all incidents in compliance with AR 73-XX on the forms reflected in DA Pam 73-XX. See DA Pam 73-XX for distribution guidance.

e. Supervise property accountability, ensuring that statements are made when the event-incident occurs.

f. Seek assistance in keeping add-on testing to a minimum or forbidding it.

g. Emphasize the sequence of events frequently to the test unit commander and his S3.

h. Document deviations from detailed test plan.

i. Document problems and submit an after action report.

j. Conduct a midtest review.

k. Conduct visitor briefings as appropriate.

Figure 5-11 (cont). Test execution checklist

7. End test.

a. Clean up and return test items.

b. Clean up and turn in equipment.

c. Clear up all hand receipts.

d. Release support personnel after all equipment has been turned in.

e. Release data collectors-evaluators only after ensuring that all data is in and quality checked by the data manager.

f. Prepare recognition for test participants.

g. Finalize test reports.

Figure 5-11 (cont). Test execution checklist

LEVEL	DESCRIPTION	POSSIBLE FORMS	EXAMPLES OF CONTENT	DISPOSITION
Level 1 data "raw data"	Data in their original form. Results of field trials just as recorded.	Complete data collection sheets, exposed camera film, voice recording tapes, original instrumentation magnetic tape or printouts, original videotapes, filled questionnaires, interview notes.	1. All reported target presentations and detection. 2. Clock times of all events. 3. Azimuth and vertical angle from each flash base for each flash. 4. Recording tapes of interviews.	Accumulated during trials for processing. Usually discarded after use. Not ordinarily given to another agency. Not published.
Level 2 data "reduced data"	Data taken from the raw form and consolidated. Invalid or unnecessary data points deleted. Trials declared "no test" deleted.	Confirmed and corrected data collection sheets, film with extraneous footage deleted, corrected tapes of printouts, and original raw data with "no test" events marked out.	1. Record of all valid detections. 2. Start and stop times of all applicable events. 3. Computed impact points of each round flashed. 4. Confirmed interview records.	Produced during processing. Usually discarded after use. Not published.
Level 3 data "ordered data"	Data which have been checked for accuracy and arranged in convenient order for handling. Operations limited to counting and elementary arithmetic.	Spread sheets, tables, typed lists, ordered and labeled printouts, purified and ordered tape, edited film, edited magnetic tapes, ordered punch cards.	1. Counts of detections arranged in sets showing conditions under which detections occurred. 2. Elapsed times by type events. 3. Impact points of rounds by condition under which fired. 4. Interview comments categorized by type.	Not usually published but made available to analysts. Usually stored in institutional data banks. All or part may be published as supplements to test report.
Level 4 data "findings" or "summary statistics"	Data which have been summarized by elementary mathematical operations. Operations limited to descriptive summaries; no judgments or inferences. Does not go beyond what was observed in test.	Tables or graphs showing totals, means, medians, modes, maximums, minimums, quartiles, deciles, percentiles, curves, or standard deviations. Qualitative data in form of lists, histographs, counts by type, or summary statements.	1. Percentage of presentations detected. 2. Mean elapsed times. 3. Calculated probable errors about the centers of impact or conditions. 4. Bar graph showing relative frequency of each category of comment.	Published as the basic factual findings of test report.

Figure 5-12. Levels of data

LEVEL	DESCRIPTION	POSSIBLE FORMS	EXAMPLES OF CONTENT	DISPOSITION
Level 5 data "analysis" or "inferential statistics"	Data resulting from statistical tests of hypothesis or interval estimation. Execution of planned analysis data. Includes both comparisons and statistical significance level. Judgments limited to analysts selection of techniques and significant levels.	Results of primary statistical techniques such as T-tests, Chi-square, F-test, analysis of variance, regression analysis, contingency table analyses and other associated confidence levels. Follow-on tests of hypotheses arising from results of earlier analysis, or fallback to alternate nonparametric technique when distribution of data does not support assumption of normality. Qualitative data in the form of prevailing consensus.	1. Inferred probability of detection with its confidence interval. 2. Significance of difference between two mean elapsed times. 3. Significance of difference between observed probable error and criterion threshold. 4. Magnitude of difference between categories of comments.	Published in evaluation reports. (If evaluation report is part of test report, the level 5 analysis results are presented separately from the level 4 findings.)
Level 6 data "extended analysis" or operations	Data resulting from further analytic treatment going beyond primary statistical analysis, combination of analytic results from different sources, or exercise of simulation or models. Judgments limited to analysts' choices only.	Insertion of test data into a computational model or a combat simulation, aggregation of data from different sources observing required disciplines, curve fitting and other analytic generalization, or other operations research techniques such as application of queuing theory, inventory theory, cost analysis, or decision analysis techniques.	1. Computation of probability of hit based on target detection data from test combined with separate data or probability of hit given a detection. 2. Exercise of attrition model using empirical test times distribution. 3. Determination of whether a trend can be identified from correlation of flash base accuracy data under stated conditions from different sources. 4. Delphi technique treatment of consensus of interview comments.	Published as appropriate in evaluation reports.
Level 7 data "conclusions" or evaluation	Data conclusions resulting from applying evaluative military judgments to analytic results.	Stated conclusions as to issues, position statements, challenges to validity or analysis.	1. Conclusion as to whether probability of detection is adequate. 2. Conclusion as to timeliness of system performance. 3. Conclusion as to military value of flash base accuracy. 4. Conclusion as to main problems identified by interviewees.	Published as the basic evaluative conclusions of evaluation reports.

Figure 5-12 (cont). Levels of data

Chapter 6
Operational Test and Evaluation Reporting

Section I
General

6-1. Purpose
This chapter provides policy and procedural guidance for the test officer and the evaluator on test reporting, system evaluations, and system assessments. This chapter also provides guidance and suggestions for the test officer and the evaluator when preparing a report of test, evaluation, or assessment.

6-2. Scope
This chapter addresses the following reporting, evaluation, and assessment documents: Test and Evaluation Reports (TER), Operational Assessments (OA), Early Operational Assessments (EOA), Abbreviated Operational Assessments (AOA), Test Reports (TR), Preliminary Test and Evaluation Reports-Test Design and Data Base (PTER-TDDB), and Preliminary Operational Assessments-Test Design and Data Base (POA-TDDB).

6-3. Applicability
This chapter applies to OTE of materiel systems and Information Mission Area (IMA) systems, and to user tests of combat and training developments products.

Section II
Mission

6-4. Test mission
Conducting tests is the primary mission of the Operational Tester (OT). The term OT is used throughout this chapter to describe the test organization, normally TEXCOM. The term "tester" describes the test officer or test director responsible to the OT for test conduct. The term "test analyst" describes the individual(s) that provide analytic support to the tester.

6-5. Evaluation mission
Evaluating or assessing the system operational effectiveness and suitability using the results of testing is the primary mission of the IOE. The term IOE is used throughout this chapter to describe the evaluation organization, normally OEC. The term "evaluator" describes the individual responsible to the IOE for

system evaluation. The term "analyst" describes the individual(s) that provide analytic support to the evaluator.

Section III
Reports

6-6. General
The end product of the test mission and the evaluation mission is a report and subsequent briefing and recommendations to the Materiel Acquisition Process (MADP)/Major Automated Information System Review Council (MAISRC) decision body. The approved report is distributed throughout the Army and other Department of Defense (DOD) elements.

6-7. Reporting standards
The report must be timely, well written, and contain all the information necessary to make high-level decisions. A defective report loses the validity and reliability of a test even though the test may be well-conducted and the evaluation well reasoned and thorough.

6-8. Report preparation
Throughout the OTE cycle, utilize all previous efforts on planning, testing, and reporting in the preparation of a TER or other reporting document. The report requires certain introductory and explanatory material to make it a stand-alone document and varies substantially in size and form depending on the size and scope of the test, evaluation, or assessment.

Section IV
Reporting Documents

6-9. Use of evaluations and assessments
Evaluations and assessments provide formal analyses of the system's operational effectiveness and suitability to decision makers at milestone decision review (MDR). Assessments may also provide periodic status reports throughout the life cycle of a system whenever continuous evaluation identifies changes occurring in the status of the system.

6-10. Purpose of TER, OA, EOA, and AOA
These document each and every independent operational evaluation or assessment. They address and answer the critical and additional issues in the TEP based on all available data and analytic treatment of that data.

6-11. Differences between evaluations and assessments
In evaluations, the IOE draws conclusions on system operational effectiveness and system operational suitability. In assessments, the IOE makes findings on progress towards required effectiveness and suitability and the adequacy of system programmatics in place to meet the requirements at a given future point.

6-12. Content of TER, OA, EOA, and AOA
Evaluations and assessments contain analyses and supporting rationale for the conclusions, data summaries, positions on the future capability of the system to fulfill approved requirements, program constraints, and impacts on the evaluation. The final draft report is provided to the MDR prior to the decision meeting in accordance with AR 70-1 or AR 25-3. AOA may be used to update positions as required.

6-13. Test reporting
In addition to its evaluation function, the TER, OA, or EOA is also the primary record of the operational test, i.e., EUTE, LUT, IOT, and FOT. Every operational test concludes with a TER, OA, or EOA. Other user tests (FDTE, CEP, CT) conclude with a TR. Operational testing supports operational evaluations or assessments by generating relevant data not obtainable through other sources.

6-14. Test report content

a. The report of test, incorporated into the TER, OA, or EOA, presents the factors and conditions used in conduct of the test, documents the data base created in the test, and presents the level 3 and higher data (both qualitative and quantitative) resulting from the test. The report requires certain introductory and explanatory material and varies substantially in size and form depending on the test. In every case, it fully and accurately states what was done and what resulted.

b. Any departures from the TEP, as well as unexpected conditions encountered, are reported along with explanations necessary to evaluate the adequacy and validity of the test. Test data are limited to findings of fact rather than conclusions, and therefore, reporting of data and test occurrences are not subject to concurrence by any other activity. No approving echelon has the authority to change the reported facts.

6-15. AE system tests
The TER for AE systems documents testeranswers to the critical and additional issues in the TEP based on data from the test and

analytic treatment of that data. In these reports, the OT draws conclusions on system operational effectiveness and suitability based solely on the results of the user test.

6-16. Other user tests (FDTE, CEP, CT)
The TR for FDTE, CEP, and CT documents answers to the user issues in the TEP based on available data and develops and documents conclusions derived from the answers to the issues by the tester.

6-17. Preliminary reports
For full-evaluate systems, the OT prepares and approves a preliminary report (PTER-TDDB or POA-TDDB). This report provides a description of the test and the level 3 data base to interested DA and DOD elements. The preliminary report is a partial report which is produced as a part of the development of the complete TER, OA, or EOA. There is no additional effort required to produce this report. This report is not an interim report, it draws no conclusions, and it provides no analysis. It is merely a vehicle to get final test data to the program manager, technical evaluator, DA staff, and DOTE.

Section V
Executive Summaries

6-18. Executive summary purpose
Executive summaries of TER, OA, and EOA provide the essence of the primary document to other members of the acquisition team and decision makers. Executive summaries also provide advance notice of the content of the document while it goes through the review, approval, and publication process.

6-19. Requirements
The executive summary is only required if the body of the TER/TR exceeds twenty-five pages. If the volume of the TER is less than twenty-five pages, an executive summary is optional. The executive summary is also optional for all CEP and CT.

6-20. Executive summary writing

a. The evaluator and tester jointly prepare the executive summary for all TER for full-evaluate systems and for all OA/EOA for full-evaluate systems (with user tests). The evaluator has the lead for the executive summary and assigns the tester (as a member of the system task force) to write pertinent portions of the executive summary as appropriate. The evaluator prepares the executive summary in its entirety for all OA/EOA for full-

evaluate systems (with no user test). The tester prepares the executive summary for all TER (AE) and TR for FDTE, CEP, and CT.

b. The executive summary provides an overview of the test and of the evaluation/assessment and their results, and should be written after the draft of all the chapters of the report are written. The executive summary is to be written for senior officials and decision makers and is to be on the order of 30 pages or less. In general, smaller is better. It may be detached from the remainder of the report and is therefore to be written so that it can stand alone.

c. When forwarding the executive summary to the decision makers as a separate document, append the signature block and the signature of the Commander, OPTEC to the end of the executive summary.

6-21. Executive summary standards.

a. A good executive summary avoids repeating verbatim entire sections from the remainder of the report. It is a comprehensive and brief abstract, recapitulation or compendium of facts or statements from the body of the report referring the reader to the report body or appendixes, where appropriate, for more details or information.

b. The executive summary shall contain only information which is reported in the body of the report and reference the charts, graphs, illustrations, and photographs as much as possible to present the essential information briefly and concisely.

Section VI
Other Reporting Media

6-22. Independent evaluator briefings (IEB)

a. IEB based on the TER, OA, or EOA, the advance executive summary of these documents, or emerging results provide input as necessary to members of the acquisition team and to decision makers. IEB follow the same outline as the executive summary.

b. Evaluators prepare formal IEB and present these briefings to the decision bodies at each MDR. The briefing summarizes the report submitted to the body (DAB, ASARC, MAISRC, or IPR panel) and contributes to recommendations by the review body to the decision maker as well as to management decisions by the review body.

6-23. Cover memoranda

a. The IOE forwards reports and assessments to the decision body (ASARC, MAISRC, IPR, or MRRB) by a memorandum prepared by the evaluator. The memorandum contains transmittal information and the final OPTEC ASARC/MAISRC/IPR/MRRB position. Full evaluate system memoranda will be signed by CG, OPTEC. AE memoranda will be signed by the IOE commander.

b. The OT forwards TR to TRADOC using a cover memorandum prepared by the tester and signed by the OT commander. The tester prepares memoranda for CG, TEXCOM to forward preliminary reports (PTER-TDDB, POA-TDDB) for full evaluate to acquisition team members as specified by OEC.

Section VII
Full Evaluation Reports

6-24. General
Only the documents described in this chapter will be used to report the results of operational testing, operational evaluations, and operational assessments. Figure 6-1 is a graphic decision chart to be used to select the appropriate document.

(INSERT FIGURE 6-1)

6-25. Format
Reporting documents use a single, standard format that may be easily tailored to all of the various documents required by this chapter. Figure 6-2 shows this format.

(INSERT FIGURE 6-2)

6-26. The TER for full evaluate systems

a. The evaluator and the tester jointly write a TER (using the format in Figure 6-2) for all full-evaluate systems after materiel/IMA life cycle user tests of the complete system to include IOT and those FOT where the test is conducted in the same manner as an IOT (full FOT). The title of the TER implies to the decision maker or other reader that the evaluation is based on a full operational test of the entire system (as well as the results of FDTE, CEP, CT, DT, contractor tests, market surveys and investigations, modeling and simulation, or studies and analyses). The TER is the primary record of the operational test

and the operational evaluation supporting the MADP or MAISRC decision.

b. The tester prepares chapters 1 and 2 of the TER with input and assistance from the evaluator who is part of the test team. The tester prepares the PTER-TDDB based on chapters 1 and 2. Figure 6-3 provides the format for a PTER-TDDB. The evaluator prepares chapters 3 and 4 with input and assistance from the tester who is part of the system task force. For some appendixes, the evaluator has the lead. For the remainder of the appendixes, the tester has the lead.

(INSERT FIGURE 6-3)

c. A TER reports the results of a dedicated phase of operational testing and the evaluation of the system operational effectiveness and suitability. Evaluations are based on results of the operational test plus available technical, contractor, or other user (FDTE, CEP, CT) testing. Evaluations consider results of modeling, simulation, market surveys or investigations, and any other studies or analyses.

d. The report documents the test and the evaluation and contains an analysis addressing the issues involved, the IOE conclusions, major findings, analyses and supporting rationale for the conclusions, a position on the future capability of the system to fulfill the approved requirements, program constraints and their impact on the evaluation, and IOE recommendations.

e. CG, OPTEC approves and releases the TER and signs the cover memorandum sending the TER to the ASARC, MAISRC, or IPR. Format for cover memoranda is at figure 6-4. The IOE and OT commanders also sign the TER. The tester commander approves the release of PTER-TDDB and signs a transmittal memorandum.

(INSERT FIGURE 6-4)

6-27. OA or EOA for full evaluate systems (after a dedicated phase of operational testing)

a. An OA or EOA following a user test uses the same format and procedures as a TER. (See figure 6-2.) Assessments differ from the TER only in the title of the report and the designations of some paragraphs within the report. The only difference between an OA and an EOA is that prior to MS II, designate the document as an EOA. After MS II, designate the document as an OA.

b. The evaluator and the tester jointly write an OA for all full-evaluate systems after materiel/IMA life cycle user tests of less than the complete system to include LUT and those FOT where the test has been tailored to something less than an IOT equivalent (i.e., it has been tailored to resemble an LUT). The evaluator and the tester jointly write an EOA for all full-evaluate systems after early materiel/IMA life cycle user tests of less than the complete system to include EUT, EUE, and those FDTE or CEP conducted in lieu of EUTE.

c. The title of the OA or EOA implies to the decision maker or other reader that the assessment is based on a less than full operational test of the entire system and IOE "conclusions" are assessments of progress toward system requirements and goals and findings on the adequacy of programmatics toward this end. The results of FDTE, CEP, CT, DT, contractor testing, market surveys and investigations, modeling and simulation, or studies and analyses are also included in the assessment.

d. The OA or EOA is the primary record of an operational test and the operational assessment supporting a MADP or MAISRC decision. Every EUTE, LUT, and every FOT conducted in the same manner as a LUT (abbreviated FOT) concludes with a OA or EOA.

e. The tester prepares chapters 1 and 2 of the OA/EOA with input and assistance from the evaluator who is part of the test team. The tester prepares the POA-TDDB based on chapters 1 and 2 (using the format in figure 6-3). The evaluator prepares chapters 3 and 4 with input and assistance from the tester who is part of the system task force. For some appendixes, the evaluator has the lead. For the remainder of the appendixes, the tester has the lead.

f. OA or EOA report the results of a dedicated phase of operational testing and assessment of the system operational effectiveness and suitability. Assessments are based on results of the operational test plus available development, contractor, or other user (FDTE, CEP, CT) testing. Assessments consider results of modeling, simulation, market surveys or investigations, and any other studies or analyses.

g. The report documents the assessment and contains an analysis addressing the issues involved, the IOE conclusions, major findings, analyses and supporting rationale for the conclusions, a position on the future capability of the system to fulfill the approved requirements, program constraints and their impact on the assessment, and IOE recommendations.

h. CG, OPTEC approves and releases the OA/EOA and signs the cover memorandum sending the OA/EOA to the ASARC, MAISRC, or IPR. Format for cover memoranda is at figure 6-4. The IOE and OT commanders also sign the OA/EOA. The tester commander approves the release of POA-TDDB and signs the transmittal memorandum.

6-28. OA or EOA for full evaluate systems (with no dedicated phase of operational testing)

a. An OA or EOA with no user test uses a tailored TER format and procedures. (See figure 6-2.) These assessments differ in the designations and omissions of some paragraphs and appendixes within the report. The only difference between an OA and an EOA is that prior to MS II, designate the document as an EOA. After MS II, designate the document as an OA.

b. The OA or EOA is the primary record of an operational assessment supporting a MADP/MAISRC decision where no EUTE, LUT, IOT, or FOT has been conducted. The evaluator prepares all parts of the OA/EOA.

c. The evaluator writes an OA or an EOA for all full-evaluate systems prior to all materiel/IMA life cycle decision points not supported by EUTE, LUT, IOT, or FOT (i.e., supported by DT, contractor testing, market surveys and investigations, modeling and simulation, studies and analyses, or combat/training developer planned FDTE, CEP, or CT). The evaluator also writes an OA or EOA to report the results of CE to the decision maker when CE events dictate the need for a report prior to the next milestone.

d. The title of the OA or EOA implies to the decision maker or other reader that the assessment is based on a less than full operational test of the entire system and IOE "conclusions" are assessments of progress toward system requirements and goals and findings on the adequacy of programmatics toward this end.

e. An OA or EOA reports the assessment of the system operational effectiveness and suitability. Assessments are based on results of available development, contractor, or other user (FDTE, CEP, CT) testing. Assessments consider results of modeling, simulation, market surveys or investigations, and any other studies or analyses.

f. The report documents the assessment and contains an analysis addressing the issues involved, the IOE conclusions, major findings, analyses and supporting rationale for the conclusions, a position on the future capability of the system to

fulfill the approved requirements, program constraints and their impact on the assessment, and IOE recommendations.

g. CG, OPTEC approves and releases the OA/EOA and signs the cover memorandum sending the OA/EOA to the ASARC, MAISRC, or IPR. Format for cover memoranda is at figure 6-4. The IOE commander also signs the OA/EOA. There is no preliminary report.

Section VIII
Abbreviated Evaluation Reports

6-29. TER(AE)

a. For AE systems, the operational test provides all the data and insight required to draw analytic conclusions on effectiveness and suitability. The tester writes a TER(AE) for all AE systems after any and all materiel/IMA life cycle operational tests to include EUTE, LUT, IOT, and FOT. A TER(AE) contains the report of test plus analytic findings and conclusions on operational effectiveness and suitability by the tester. The format of a TER(AE) is shown in figure 6-2.

b. This TER(AE) is the primary record of an operational test for an AE system. Every operational test for an AE system concludes with a TER(AE).

c. For AE systems, the tester prepares the TER in its entirety. The OT commander signs the report and releases it to the OEC commander for transmittal to the IPR. There is no PTER-TDDB or POA-TDDB for AE systems.

6-30. AOA for full evaluate systems

a. The evaluator writes an AOA for all full-evaluate systems prior to any and all materiel/IMA life cycle decision points not otherwise supported by a TER, OA, or EOA. The format for an AOA is shown in figure 6-5.

(INSERT FIGURE 6-5)

b. The primary use of the AOA for these systems is at MS I and at Materiel Release Decisions subsequent to MS III. The AOA may also be used to report a CE event between milestones in lieu of a full OA or EOA. The Commander, OEC approves the AOA and signs the cover memorandum sending the AOA to Commander, OPTEC. Format for cover memoranda is at figure 6-4.

c. The AOA is used when little or no new information on the system is available and contains summary assessments of operational effectiveness and suitability by the evaluator.

6-31. AOA for AE systems

a. The evaluator writes an AOA for all AE systems prior to any and all materiel/IMA life cycle decision points using the format in figure 6-3. Where a TER(AE) is available to support the decision point, the AOA contains confirmation of tester evaluative findings by the evaluator. The TER(AE) will be provided to the decision maker along with this AOA.

b. Where a TER(AE) is not available to support the decision point, the AOA contains summary assessments of operational effectiveness and suitability by the evaluator. A combined TT/OT report may be referenced in the AOA.

c. The OEC commander approves the AOA and signs the cover memorandum sending the AOA (and any available TER(AE)) to the Commander, OPTEC. Format for cover memoranda is at Figure 6-4. There is no preliminary report.

Section IX
Other Reports

6-32. TR

a. The TR is the primary record of the user test of a materiel or IMA system or a combat/training developments product (i.e., doctrine, training, organization, leader development, materiel requirements) conducted as a FDTE, CEP, or CT. Each of these user tests concludes with a TR. The tester prepares the TR in its entirety using the format in figure 6-2.

b. The TR is written by the tester after FDTE, CEP, and CT. This TR contains the report of test by the tester for the test sponsor.

c. The report may or may not include evaluative findings of the tester depending on the requirements of the test sponsor. IOE involvement is only applicable where the results may be used in CE or in evaluation or assessment reports.

6-33. Combined DT and OT

a. When the DT and the OT are combined into a single test which substitutes for IOT or full FOT, a TER is written on the operational portions of the test. IOE evaluation also includes the DT data from the combined test. Alternatively, the operational tester may agree to write a combined test report with the development tester and the TER may contain the evaluation with the combined DT/OT report included as an appendix.

b. When the DT and the OT are combined into a single test which substitutes for EUTE, LUT, or abbreviated FOT, an OA or EOA is written on the operational portions of the test. IOE assessment also includes the DT data from the combined test. Alternatively, the operational tester may agree to write a combined test report with the development tester and the OA or EOA may contain the assessment with the combined DT/OT report included as an appendix.

c. When the DT and the OT are combined into a single test which substitutes for any user test of an AE system, a TER(AE) is written on operational portions of the test. Analytic conclusions may include DT data where needed to address those OT issues examined only in DT portions of the combined test. Alternatively, the operational tester may write a combined test report with the development tester which contains the OT analytic conclusions as an appendix.

Section X
Milestones

6-34. Reporting milestones

All milestones are to be interpreted as "not to exceed" dates for planning. Testers and evaluators will make every effort to complete reports and assessments as quickly as possible.

6-35. Milestone schedule for completion of combined TER, OA, and EOA (See figure 6-6.)

(INSERT FIGURE 6-6)

6-36. Milestone schedule for completion of evaluator-only OA and EOA (See figure 6-7.)

(INSERT FIGURE 6-7)

6-37. Milestone schedule for completion of TER(AE) and AOA (See figure 6-8.)

(INSERT FIGURE 6-8)

6-38. Milestone schedule for completion of TR (See figure 6-9.)

(INSERT FIGURE 6-9)

Section XI
Methodology and Procedures

6-39. Report writing

a. Whether the report format is a TER, TER(AE), OA/EOA, or TR, test planning requirements for test and evaluation will not change. The only significant change to result from the TER concept is a joint approach procedure by the tester and evaluator for preparation of reports for full-evaluate systems.

b. The responsibilities of the tester and the evaluator during report preparation are described in the following paragraphs. Detailed guidance for report preparation is covered in figure 6-11 at the end of the chapter.

6-40. TER, OA, or EOA for full evaluate systems
This report is the most comprehensive and important document prepared by OPTEC. With joint authors, it requires intensive coordination between the tester and evaluator. In the preparation of these reports, the following procedures will apply:

a. During the development of chapters 1 and 2 of the TER, the OT test team will have the lead with evaluator input and assistance. The evaluator and his analyst will work closely with the test team and will normally be collocated with the test team.

b. Chapters 1 and 2 are basically the responsibility of the tester with necessary input from the evaluator. The tester will complete and publish the two chapters and necessary appendixes as the PTER-TDDB or POA-TDDB. (See figure 10-8 for format.) These two chapters will constitute the preliminary report, will reflect the test results, and will provide other DA and DOD agencies valuable information as quickly as possible.

c. During the development of chapters 3 and 4 of the report, the evaluation system task force will have the lead with tester input and assistance as a member of the system task force. The evaluator will chair the system task force. Chapters 3 and 4 are

the responsibility of the evaluator with necessary input from the tester.

d. Chapter 3 is prepared with significant contributions and support from the tester and from the test analyst. Only one set of level 4 test data is included in the combined report. The test officer and necessary test analysts must support and provide necessary assistance to the evaluator during the production of the level 4 and higher test and evaluation data.

e. Once these last two chapters are finished, the evaluator (with tester input) completes the executive summary and the complete report is published.

f. The evaluator writes an OA or EOA for full-evaluate systems with no user test. This OA or EOA normally has little, if any, tester input.

6-41. TER(AE)
The tester will complete and publish all four chapters of the TER for an AE system. The evaluator will complete the assessment in an AOA. Coordination is required to assure the TER(AE) and AOA are properly "married up" with each other.

6-42. TR after FDTE, CEP, or CT
A TR is written by the tester and normally has little, if any, IOE input.

6-43. AOA
AOA for full-evaluate systems and those AE systems where no tester TER is or will be available to support the decision point are completed by the evaluator to meet the suspense to provide input to the decision point and do not have a detailed milestone schedule.

6-44. Strawman reports

a. Prior to start of test, both the evaluator and the tester should be performing report related activities. In the final stages of planning, the tester and evaluator should be concerned with ensuring that the data base structure is developed, is adequate to support the reports, and is consistent with the TEP.

b. As the planning phase is being completed, the tester and evaluator will begin development of a strawman report based on the TEP and expected results from the test. The strawman report outlines the information to be presented to ensure that voids or gaps do not exist in the TEP. The strawman report will include all the information that is available prior to the test.

c. For each issue, the tester and evaluator will determine the best method for presenting the data to answer the MOE/MOP. If tabular data are to be presented, they will show how the data will be set up in the table. If data from questionnaires are to be used, text can be used with blank spaces for the distribution of questionnaire responses. They prepare an outline of the information to be presented to decision makers to ensure that all required data to fully evaluate the system will be obtained from the operational test or from or other sources.

d. The evaluator will use the strawman report to outline how he will combine data from all available sources into the report. Of primary importance to the tester are the data displays of test data required by the evaluator. The outline for a strawman report is the same as the format for the final report and should be consistent with the information provided in the TEP.

Section XII
Offices of Record

6-45. Office of record for reports and assessments
The office of record for a T&E reporting document will be either the evaluator or the tester. Offices of record responsibilities are assigned as follows:

a. Full evaluate systems after EUTE, LUT, IOT, or FOT. The tester is the office of record for these reports until approval of the preliminary report. After approval of the preliminary report, the evaluator becomes the office of record.

b. Abbreviated evaluate systems after EUTE, LUT, IOT, or FOT. The tester is always the office of record for TER(AE).

c. Full-evaluate systems without EUTE, LUT, IOT, or FOT. The evaluator is always the office of record for all reports.

d. TR for FDTE, CEP, and CT. The tester is always the office of record for all TR.

e. AOA. The evaluator is always the office of record for all AOA.

6-46. Office of record responsibilities
The office of record is responsible for the following:

a. Maintenance of configuration control on the document as it evolves to include maintenance of the "most current" version.

b. Incorporation of all changes regardless of the source of the changes.

c. Maintenance of the approval sheet original copy.

d. Printing and reproduction of copies for distribution.

e. Submission of documents to DTIC and other data bases.

f. Maintenance of the record copy after approval.

g. All editorial services.

6-47. Document and data retention
In order to have a complete historical file on all tests conducted, each agency must retain all documents for a period of time. Figure 6-10 provides retention guidance.

(INSERT FIGURE 6-10)

Section XIII
Reporting Standards

6-48. General
A report should always be able to stand the test of clarity and conciseness. Two general characteristics mark effective writing: First, it has something to say; and second, it says only what the writer intends to say. It must be free from factual and mechanical errors and should present only essential facts, free from bias and distortion. Using a simple style which avoids pretentious words and phrases will improve clarity. The reader must be certain of the writer's exact meaning; therefore, writing must be clear and free from misinterpretation.

6-49. Use of trade names and code sheets
Reports will not advertise products or contain material which implies that the government endorses or favors products of commercial organizations. Products will be identified by either generic names, standard Army nomenclature, or specifications. When it is essential that trade names or manufacturer's names be used, the writer should contact an editor to obtain the correct procedures.

6-50. Draft report disclaimer
Draft reports will carry the following disclaimer: "The contents of this document reflect the views of (test director, installation, location) and are not to be construed as the

official position of the Commander, TEXCOM; the Commander, OPTEC; or the Department of the Army."

6-51. Classification markings
The materiel developer provides a system classification guide to be used in the preparation of any test documents. If data obtained during testing are classified, the report has to have proper markings. Document classifications are determined by the test officer and the evaluator at the time of writing the report. AR 380-5 provides classification guidance.

6-52. Tables, charts, and figures
These should be understandable even if they are not referenced to their corresponding paragraphs, i.e., if they are separated from the report.

6-53. Units, labels, titles, and terms
These are to be clear and abbreviations explained in footnotes. Use of these items is to be consistent throughout the report.

6-54. Data explanations
If no data were available for a particular set of conditions within a display the notation "--" is to be used (not a blank space) and the reason why explained in a footnote. Definitions necessary for a data presentation to stand alone are generally to be given in footnotes. Explanations for unusual data points are normally to appear in footnotes.

6-55. Small data sets
When a small data set is small (listed on one page or less), the entire data set is to be given, not summarized.

6-56. Summary statistics
When summary statistics are computed for any data set, explicit references to the data base are to be given in enough detail that the presentation can be recreated from the data base. Any summary is to include the following statistics as a minimum: sample size, at least one measure of central tendency (e.g., mean, median) and at least one measure of variability (e.g., standard deviation, range).

6-57. OTE reporting definitions
The following definitions are important to preclude any confusion prior to writing the report.

a. Test dates.

(1) Test resource date (R-date).

(2) Test start date (T-date). T-date is defined as the date on which data collection for record begins. Pretest training and pilot test activities are accomplished prior to T-date.

(3) Test end date (E-date). E-date is defined as the date on which data collection for record completes. Supporting assets are normally released at or shortly after E-date.

(4) Test completion date (C-Date). C-date is defined as the date the validated and authenticated test data base is completed. Normally, C-date will be not later than twenty calendar days after the last test event.

b. Finding. A finding is a result which is limited to fact and is derived from test data. These data are the results of computations or other mathematical operations performed, or they are decisions based on the data as preset conditions or criteria.

c. Conclusion. A conclusion is an interpretive evaluation of findings based solely on data collected during the test. Conclusions will not include any suitability type statement such as suitability or acceptability for production, deployment, or continued development of material.

d. Recommendation. Recommendations are based solely on findings and conclusions.

e. Observation. Observations by test directorate personnel or observers are opinions that are part of test conduct and documented in chapter 2 and are not part of the data collection process.

(INSERT FIGURE 6-11)

REPORTING DOCUMENT SELECTION MATRIX

FULL EVALUATE SYSTEMS	WITH USER TEST	NO USER TEST
MILESTONE 0	EOA(joint)*	AOA**
MILESTONE I	EOA(joint)*	EOA or AOA
MILESTONE II	EOA(joint)	EOA
LRIP RELEASE	OA(joint)	OA
MILESTONE III	TER(joint)	N/A
POST MILESTONE III	TER(joint) or OA(joint)	OA
MILESTONE IV	N/A	AOA or OA
MATERIEL RELEASE	N/A	AOA
AS NEEDED SPOT REPORT	N/A	EOA, OA, or AOA

ABBREVIATED EVALUATE SYSTEMS	WITH USER TEST	NO USER TEST
MILESTONE 0	N/A	AOA*
MILESTONE I	N/A	AOA
MILESTONE II	TER-AE and AOA	AOA
LRIP RELEASE	TER-AE and AOA	AOA
MILESTONE III	TER-AE and AOA	N/A
POST MILESTONE III	TER-AE and AOA	AOA
MILESTONE IV	N/A	AOA
MATERIEL RELEASE	N/A	AOA
AS NEEDED SPOT REPORT	N/A	AOA

COMBAT AND TRAINING DEVELOPMENTS PRODUCTS
ALL TESTS ARE REPORTED WITH TR

*   only if user test is conducted.
** only if issues must be addressed by the evaluator.

Figure 6-1. Reporting document selection matrix

PRESCRIBED FORMAT FOR ALL TEST, EVALUATION,
AND ASSESSMENT REPORTING DOCUMENTS
(TER, TER(AE), OA, EOA, AND TR)

THIS FORMAT IS FOR THE TEST AND EVALUATION REPORT (TER) FOR FULL EVALUATE SYSTEMS AFTER IOT OR FULL FOT (TAILORING THE FORMAT TO FIT OTHER TYPES OF TESTS, EVALUATIONS, AND ASSESSMENTS IS ACCOMPLISHED BY FOLLOWING INSTRUCTIONS NOTED BELOW).

FRONT COVER

APPROVAL PAGE

DISCLAIMER FOR TRADE NAMES (if required)

REPORT DOCUMENTATION PAGE, STANDARD FORM 298

EXECUTIVE SUMMARY (For TER (AE) and FDTE TR where report body is 25 pages or less, the executive summary is not required. For TR of CEP or CT, the executive summary is not required.)

I. PURPOSE.
II. BACKGROUND.
III. SYSTEM DESCRIPTION ("Description" in TR).
IV. TEST CONDUCT ("Data Sources" in OA/EOA with no user test).
V. TEST AND EVALUATION LIMITATIONS AND IMPACT ("Test and Assessment Limitations and Impact" in OA/EOA after EUTE, LUT, or abbreviated FOT, "Assessment Limitations and Impact" in OA/EOA with no user test, "Test Limitations" in TER (AE) and in TR).
VI. OPERATIONAL EFFECTIVENESS SUMMARY ("Conclusions and Recommendations" in TR).
    - VI.1. Issue Summary.
        - VI.1.1. Issue 1.
        - VI.1.2. Issue 2.
        - (through)
        - VI.1.n. Issue n.
    - VI.2. Overall Operational Effectiveness Assessment (Titled as "Overall Assessment" in a TR).
    - VI.3. Operational Effectiveness Recommendations (Titled as "Recommendations" in a TR).

Figure 6-2. Presribed format for all test, evaluation, and assessment reporting documents

PRESCRIBED FORMAT FOR ALL TEST, EVALUATION,
AND ASSESSMENT REPORTING DOCUMENTS
(TER, TER(AE), OA, EOA, AND TR)
(CONTINUED)

VII. OPERATIONAL SUITABILITY SUMMARY ("Not Used" in TR).
VII.1. Issue Summary.
VII.1.1. Issue 1.
VII.1.2. Issue 2.
(through)
VII.1.n. Issue n.
VII.2. Overall Operational Suitability Assessment.
VII.3. Operational Suitability Recommendations.
VIII. TEST OFFICERS OBSERVATIONS ("NOT USED" in TER/OA/EOA for
full evaluate systems).
IX. RECOMMENDATIONS FOR FUTURE OTE ("Not Used" in TER (AE)/TR).

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1.3.3. COEA/OTE RELATIONSHIP (Not used for TER (AE) or TR).
1.4. SYSTEM DESCRIPTION (Titled "Description" for TR).
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Figure 6-2. Presribed format for all test, evaluation, and assessment reporting documents (cont)

PRESCRIBED FORMAT FOR ALL TEST, EVALUATION,
AND ASSESSMENT REPORTING DOCUMENTS
(TER, TER(AE), OA, EOA, AND TR)
(CONTINUED)

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1.7. TEST AND EVALUATION LIMITATIONS AND IMPACT ("Test and Assessment Limitations and Impact" in OA/EOA after EUTE, LUT, or abbreviated FOT, "Assessment Limitations and Impact" in OA/EOA with no user test, "Test Limitations" in TER (AE) and in TR).
1.7.1. TEST LIMITATIONS AND IMPACT.
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2.5. TEST DATA MANAGEMENT.
2.5.1. DESCRIPTION OF DATA COLLECTION METHODS.
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Figure 6-2. Presribed format for all test, evaluation, and assessment reporting documents (cont)

PRESCRIBED FORMAT FOR ALL TEST, EVALUATION,
AND ASSESSMENT REPORTING DOCUMENTS
(TER, TER(AE), OA, EOA, AND TR)
(CONTINUED)

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(through)
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(through)
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3.1.1.n+1. CRITERION 1.1. FINDINGS AND DISCUSSION.
3.1.2. CRITERION 1.2.
(through)
3.1.n. CRITERION 1.n.
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(through)
3.n. ISSUE N.
CHAPTER 4. OVERALL CONCLUSIONS AND RECOMMENDATIONS (Titled "Overall Conclusions" for TER (AE), use alternate format for TR).
4.1. OPERATIONAL EFFECTIVENESS CONCLUSIONS ("Operational Effectiveness Assessment" for OA/EOA).
4.2. OPERATIONAL SUITABILITY CONCLUSIONS ("Operational Suitability Assessment" for OA/EOA).
4.3. RECOMMENDATIONS (Not used in TER (AE)).
4.3.1. SYSTEM DESIGN IMPROVEMENTS.
4.3.2. FUTURE TEST AND EVALUATION.
CHAPTER 4 (Alternate). OVERALL CONCLUSIONS AND RECOMMENDATIONS
(Format for TR).
4.1. OVERALL CONCLUSIONS.
4.2. RECOMMENDATIONS.

Figure 6-2. Presribed format for all test, evaluation, and assessment reporting documents (cont)

PRESCRIBED FORMAT FOR ALL TEST, EVALUATION,
AND ASSESSMENT REPORTING DOCUMENTS
(TER, TER(AE), OA, EOA, AND TR)
(CONTINUED)

APPENDIXES.

- APPENDIX A. DATA BASE STRUCTURE AND DATA BASE (Not used with no user test).
- APPENDIX B. SUPPLEMENTAL USER TEST DATA (Optional, not used with no user test).
- APPENDIX C. RAM DATA, COMPUTATIONS, AND SCORING CONFERENCE MINUTES (Optional for TR, not used with no user test).
- APPENDIX D. OTHER DATA SOURCES (Not used for TER (AE) or TR).
  - D.1. TEST NAME (e.g., FDT, FDE, CEP).
    - D.1.1. TEST SCOPE.
    - D.1.2. FACTORS AND CONDITIONS.
  - D.2. TEST NAME (e.g., TT, live fire test (LFT), CONTRACTOR TEST).
    - D.2.1. TEST SCOPE.
    - D.2.2. FACTORS AND CONDITIONS.
  - D.3. MODEL OR SIMULATION NAME.
  - D.4. MARKET SURVEY OR INVESTIGATION NAME.
  - D.5. OTHER STUDY OR ANALYSIS.
- APPENDIX E. SUPPLEMENTAL ANALYSIS (Not used for TER (AE) or TR).
- APPENDIX F. SCENARIO (Optional, not used with no user test).
- APPENDIX G. SYSTEM DESCRIPTION (Optional).
- APPENDIX H. THREAT (Optional, not used with no user test).
- APPENDIX I. TRAINING OF PLAYER PERSONNEL (Optional, not used with no user test).
- APPENDIX J. OBSERVATIONS BY TEST TEAM PERSONNEL (Optional, not used with no user test).
- APPENDIX K. COMMENTS FROM UNIT COMMANDERS (Optional, not used with no user test).

  (through)
- APPENDIX X. AUTHORS AND SUPPORTING PERSONNEL.
- APPENDIX Y. GLOSSARY, ACRONYMS, AND ABBREVIATIONS.
- APPENDIX Z. DISTRIBUTION.

Figure 6-2. Presribed format for all test, evaluation, and assessment reporting documents (cont)

PRESCRIBED FORMAT FOR ALL PRELIMINARY TEST
AND EVALUATION REPORTS-TEST DESCRIPTION AND
DATA BASE (PTER-TDDB) AND PRELIMINARY OPERATIONAL
ASSESSMENT-TEST DESCRIPTION AND DATA BASE (POA-TDDB)
FOR FULL EVALUATE SYSTEMS

THIS FORMAT IS FOR PTER-TDDB FOR FULL-EVALUATE SYSTEMS AFTER IOT OR FULL FOT (TAILORING THE FORMAT TO FIT POA-TDDB IS ACCOMPLISHED BY FOLLOWING INSTRUCTIONS NOTED BELOW).

FRONT COVER

APPROVAL PAGE

DISCLAIMER FOR TRADE NAMES (if required)

REPORT DOCUMENTATION PAGE, STANDARD FORM 298

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  - 1.2. SCOPE.
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Figure 6-3. Prescribed format for PTER-TDDB and POA-TDDB for full-evaluate systems

PRESCRIBED FORMAT FOR ALL PRELIMINARY TEST AND EVALUATION REPORTS-TEST DESCRIPTION AND DATA BASE (PTER-TDDB) AND PRELIMINARY OPERATIONAL ASSESSMENT-TEST DESCRIPTION AND DATA BASE (POA-TDDB) FOR FULL-EVALUATE SYSTEMS (CONTINUED)

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Figure 6-3. Prescribed format for PTER-TDDB and POA-TDDB for full-evaluate systems (cont)

PRESCRIBED FORMAT FOR ALL PRELIMINARY TEST AND EVALUATION REPORTS-TEST DESCRIPTION AND DATA BASE (PTER-TDDB) AND PRELIMINARY OPERATIONAL ASSESSMENT-TEST DESCRIPTION AND DATA BASE (POA-TDDB) FOR FULL-EVALUATE SYSTEMS (CONTINUED)

APPENDIXES.

APPENDIX A.	DATA BASE STRUCTURE AND DATA BASE.
APPENDIX B.	SUPPLEMENTAL USER TEST DATA (Optional).
APPENDIX C.	RAM DATA, COMPUTATIONS, AND SCORING CONFERENCE MINUTES.
APPENDIX D.	OTHER DATA SOURCES (Leave blank).
APPENDIX E.	SUPPLEMENTAL ANALYSIS (Leave blank).
APPENDIX F.	SCENARIO (Optional).
APPENDIX G.	SYSTEM DESCRIPTION (Optional).
APPENDIX H.	THREAT (Optional).
APPENDIX I.	TRAINING OF PLAYER PERSONNEL (Optional).
APPENDIX J.	OBSERVATIONS BY TEST TEAM PERSONNEL (Leave blank).
APPENDIX K. (through)	COMMENTS FROM UNIT COMMANDERS (Leave blank).
APPENDIX X.	AUTHORS AND SUPPORTING PERSONNEL.
APPENDIX Y.	GLOSSARY, ACRONYMS, AND ABBREVIATIONS.
APPENDIX Z.	DISTRIBUTION.

Figure 6-3. Prescribed format for PTER-TDDB and POA-TDDB for full-evaluate systems (cont)

FORMAT FOR FORWARDING MEMORANDA

(LETTERHEAD)

CSTE-EXX XX March 199X

MEMORANDUM FOR Appropriate MADP/MAISRC/IPR Decision Authority
or Materiel Release Authority

SUBJECT: Test and Evaluation Report (TER) for the (MILESTONE/DECISION) for the (SYSTEM) (or OA, EOA, AOA plus TER (AE), AOA)

1. Reference. List subject document(s) and document requesting input for the MADP, MAISRC, or materiel release decision.

2. Subject documents are enclosed for the consideration of the (MADP, MAISRC, or materiel release decision).

3. OPTEC MADP Position, MAISRC Position, or Materiel Release Position. The OPTEC position prepared by OEC.

(full evaluate)

WILLIE J. TOPDOG
Maj Gen, USA
Commanding

(or)

(abbreviated evaluate)

LORENZO P. OVERVUE
COL, AG
Commanding

Enclosures
1. TER (or OA/EOA)
2. AOA (if applicable)
3. Other enclosures are not required, but may be added if necessary.

Figure 6-4. Format for forwarding memoranda

FORMAT FOR ABBREVIATED OPERATIONAL ASSESSMENTS (AOA)

(LETTERHEAD)

CSTE-EXX XX March 199X

MEMORANDUM FOR Commander, US Army Operational Test and Evaluation Command, Park Center IV, 4501 Ford Avenue, Alexandria, VA 22302-1458

SUBJECT: Abbreviated Operational Assessment for the (MILESTONE/DECISION) for the (SYSTEM)

1. INTRODUCTION: This paragraph may be in narrative form and need not be broken into subparagraphs.

a. Purpose. A brief description of the reason(s) for writing the AOA to include identification of the system/program and the MADP, MAISRC, or materiel release decision supported by the AOA.

b. Scope. A brief description of the scope of the assessment to include mention of the data sources considered in the assessment.

c. Evaluation Limitations. A brief description of the limitations of the assessment inherent in the use of the AOA format and available data sources.

2. DATA DESCRIPTION. A brief description of each of the data sources listed in the scope and considered in the assessment. Each data source is identified in a separate subparagraph. Data sources may include user tests, technical tests, contractor tests, market surveys and investigations, modeling and simulation, studies and analyses, as well as programmatics.

3. ASSESSMENT RESULTS. This paragraph may be in narrative form and need not be broken into subparagraphs. This paragraph provides a discussion of the evaluator's assessment of actual or potential operational effectiveness and suitability of the system based on any and all available data. When the AOA addresses a TER written by the tester on an abbreviated evaluate system, this paragraph must address the TER to include an evaluator assessment of the consistency of the data, completeness of test coverage, and validity of conclusions drawn (i.e., Does the data logically support the evaluative conclusions?).

Figure 6-5. Format for AOA

FORMAT FOR ABBREVIATED OPERATIONAL ASSESSMENTS (AOA)

CSTE-EXX
SUBJECT: Abbreviated Operational Assessment for the (MILESTONE/ DECISION) for the (SYSTEM)

4. CONCLUSIONS AND RECOMMENDATIONS. This paragraph may be in narrative form and need not be broken into separate subparagraphs.

a. Overall Conclusions. The conclusions of the evaluator.

b. Recommendations. Recommendations for future testing of the system or for modifications to the system or to the program to enhance operational effectiveness or suitability.

LORENZO P. OVERVUE
COL, AG
Commanding

Enclosures
Enclosures are not required, but may be added if necessary.

NOTES ON USE OF AOA: An AOA is written in the form of a memorandum from Commander, OEC to Commander, OPTEC. A separate memorandum forwards the AOA (and the TER (AE), if applicable) to the appropriate MADP/MAISRC decision authority or to the materiel release authority. AOA are normally two pages or less. Use the AOA for a full evaluate system only to report an OPTEC position for a Milestone I decision where no user test has taken place or to report an OPTEC position for a materiel release or other non-milestone decision where an existing TER or OA exists to report previous testing and a milestone decision. Use the AOA for any and all abbreviated evaluate systems as follows:

a. When the tester writes a TER to report the results of an EUTE, LUT, IOT, or FOT for an abbreviated evaluate system, the evaluator prepares an AOA to be forwarded with the TER to the decision authority.

b. When there is no user test to support a decision, the evaluator prepares an AOA to report the OPTEC position to the milestone decision body or to the materiel release authority.

Figure 6-5. Format for AOA (cont)

MILESTONE DATES FOR TEST AND EVALUATION REPORTS (TER), OPERATIONAL ASSESSMENTS (OA), OR EARLY OPERATIONAL ASSESSMENTS (EOA) FOR FULL-EVALUATE SYSTEMS WITH OPERATIONAL TESTING

Note: TER shall be construed to mean TER, OA, or EOA. PTER shall be construed to mean PTER-TDDB or POA-TDDB.

ACTION	RESPONSIBILITY	DATE
1. Last day of record trial (i.e., last test event)	Test Officer	C-20
2. Finish validation of test data base (C-date)	Test Officer	C+00
3. Coordination draft of PTER provided to tester staff elements (and to evaluator staff elements) for internal review (this is the complete draft PTER for staffing)	Test Officer	C+10
4. Tester staff element comments on coordination draft of PTER returned to test officer	Tester HQ	C+17
5. Final draft of PTER provided to Tester staff for review and command approval	Test Officer	C+25
6. PTER approved by tester commander	Tester HQ	C+27
7. Test and evaluation emerging results brief to eval commander	Evaluator	C+30
8. Normal release of test team (other than test officer, test analyst and required data management personnel to eval STF)	Test Officer	C+30
9. Responsibility for office of record for TER preparation and approval transfers from tester to evaluator	Evaluator	C+30

Figure 6-6. Milestone dates for TER, OA, and EOA for full-evaluate systems with operational testing

ACTION	RESPONSIBILITY	DATE
10. PTER published and distributed	Tester HQ	C+30
11. Draft executive summary of the TER (OA/EOA) prepared and staffed	Evaluator w/Test Officer	C+35
12. Draft executive summary briefed to evaluation commander	Evaluator w/Test Officer	C+44
13. Submit draft executive summary of TER to OPTEC command review board process	Evaluator	C+44
14. Coordination draft TER (OA/EOA) completed and compiled for distribution	Evaluator w/Test Officer	C+49
15. Begin staffing of coordination draft TER with tester staff and evaluator staff elements	Evaluator w/Test Officer	C+50
16. Provide coordination draft of TER to DOTE through DUSA(OR)	Evaluator	C+50
17. Staff comments on coordination draft TER to evaluator and test officer	Evaluator HQ and Tester HQ	C+60
18. Command Review Board of draft EXSUM complete	OPTEC HQ	C+60
19. Executive summary of TER distribution to appropriate review agencies (copy to MDR body)	OPTEC HQ	C+60
20. TER results briefing to evaluation commander (may combine with tester briefing)	Evaluator	C+64
21. TER results briefing to tester commander (may combine with evaluator commander briefing)	Test Officer	C+64

Figure 6-6. Milestone dates for TER, OA, and EOA for full-evaluate systems with operational testing (cont)

ACTION	RESPONSIBILITY	DATE
22. Complete TER revision and submit final draft TER to evaluation and tester commanders for approval	Evaluator w/Test Officer	C+69
23. TER approved by evaluation commander and tester commander (final version of TER)	Evaluation HQ and Tester HQ	C+79
24. Submit final TER to OPTEC for review and approval	Evaluator	C+80
25. Start OPTEC Command Review Board process on final draft TER	OPTEC HQ	C+80
26. Final draft TER to MDR body for prebrief	Evaluator	C+80
27. Final draft TER to DOTE through DUSA(OR)	Evaluator	C+80
28. Prebrief of results to MDR	Evaluator	C+80
29. OPTEC Command Review Board on TER complete	OPTEC HQ	C+89
30. MDR (ASARC, MAISRC, or IPR) complete	Decision Makers	C+90
31. OPTEC approves TER	OPTEC HQ	C+93
32. Prebrief DOD Committee using approved executive summary and TER	Evaluator	C+100
33. Approved TER published and distributed	Evaluation HQ	C+104
34. Defense Acquisition Board (DAB) held	DOD	C+130

Figure 6-6. Milestone dates for TER, OA, and EOA for full-evaluate systems with operational testing (cont)

MILESTONE DATES FOR OPERATIONAL ASSESSMENTS (OA) OR EARLY OPERATIONAL ASSESSMENTS (EOA) FOR FULL-EVALUATE SYSTEMS WITH NO OPERATIONAL TESTING

NOTE: OA shall be construed to mean OA or EOA.

ACTION	RESPONSIBILITY	DATE
1. Date of cutoff of data from sources (DT, Cont Test, Mod/Sim).	Evaluator	C+00
2. Test and evaluation emerging results brief to the evaluation commander	Evaluator	C+10
3. Draft executive summary of the OA prepared and staffed	Evaluator	C+19
4. Draft executive summary briefed to evaluation commander	Evaluator	C+29
5. Submit draft executive summary of OA to command review board process	Evaluator	C+30
6. Coordination draft OA completed and compiled for distribution	Evaluator	C+34
7. Begin staffing of coordination draft OA with evaluator staff elements	Evaluator	C+34
8. Provide coordination draft of OA to DOTE through DUSA(OR)	Evaluator	C+34
9. Staff comments on coordination draft OA to evaluator	Evaluator HQ	C+44
10. Command Review Board of draft executive summary complete	OPTEC HQ	C+44
11. The executive summary of OA approved for distribution to appropriate review agencies (copy to MDR body)	OPTEC HQ	C+44

Figure 6-7. Milestone dates for OA or EOA for full-evaluate systems with no operational testing

ACTION	RESPONSIBILITY	DATE
12. OA results briefing to evaluation commander	Evaluator	C+48
13. Complete OA revision and submit final draft to evaluation commander for approval	Evaluator	C+54
14. OA approved by evaluation commander (final version of OA)	Evaluation HQ	C+54
15. Submit final OA to OPTEC for review and approval	Evaluator	C+55
16. Start OPTEC Command Review Board process on final draft OA	OPTEC HQ	C+55
17. Final draft OA to MDR body for prebrief	Evaluator	C+55
18. Final draft OA to DOTE through DUSA(OR)	Evaluator	C+55
19. Prebrief of results to MDR	Evaluator	C+55
20. OPTEC Command Review Board on OA complete	OPTEC HQ	C+64
21. MDR (ASARC, MAISRC, or IPR) complete	Decision Makers	C+65
22. OPTEC approves OA	OPTEC HQ	C+67
23. Approved OA published and distributed	Evaluation HQ	C+72

Figure 6-7. Milestone dates for OA or EOA for full-evaluate systems with no operational testing (cont)

MILESTONE DATES FOR TEST AND EVALUATION REPORTS (TER) AND ABBREVIATED OPERATIONAL ASSESSMENTS (AOA) FOR ABBREVIATED EVALUATE SYSTEMS WITH OPERATIONAL TESTING

ACTION	RESPONSIBILITY	DATE
1. Last day of record trial (i.e., last test event)	Test Officer	C-20
2. Finish validation of test data base (C-Date)	Test Officer	C+00
3. Coordination draft TER completed and compiled for distribution	Test Officer	C+39
4. Begin staffing of coordination draft TER with tester staff and evaluator staff elements	Test Officer	C+39
5. Staff comments on coordination draft TER to test officer officer	Evaluator HQ and Tester HQ	C+49
6. Begin writing AOA	Evaluator	C+50
7. Revision of TER to address agency comments completed	Test Officer	C+59
8. Final draft TER submitted to tester HQ for typesetting	Test Officer	C+61
9. Copy of camera-ready TER returned to tester for final review	Tester HQ	C+71
10. Camera-ready TER and any final comments returned to Tester HQ for final processing	Test Officer	C+74
11. TER/AOA results briefing to evaluation commander (may combine with tester briefing)	Evaluator	C+75
12. TER results briefing to tester commander (may combine with evaluator briefing)	Test Officer	C+75

Figure 6-8. Milestone dates for TER and AOA for abbreviated evaluate systems with operational testing

ACTION	RESPONSIBILITY	DATE
13. Complete TER revision and submit final draft TER to tester commander for approval	Test Officer	C+77
14. TER approved by tester commander (final version of TER)	Tester HQ	C+79
15. Complete AOA and submit to evaluation commander for approval	Evaluator	C+80
16. Approved TER published and distributed	Tester HQ	C+85
17. AOA approved by evaluation commander	Evaluator HQ	C+85
18. MDR (IPR)	Decision Makers	C+115

Figure 6-8. Milestone dates for TER and AOA for abbreviated evaluate systems with operational testing (cont)

MILESTONE DATES FOR TEST REPORTS (TR) FOR
FDTE AND FOR CEP AND CT (IN PARENTHESES)

ACTION	RESPONSIBILITY	DATE
1. Last day of record trial (i.e., last test event)	Test Officer	C-20
2. Finish validation of test data base (C-Date)	Test Officer	C+00
3. Coordination draft TR completed and compiled for distribution	Test Officer	C+39 (C+19)
4. Begin staffing of coordination draft TR with tester staff and and combat or training developer staff elements	Test Officer	C+39 (C+19)
5. Staff comments on coordination draft TR to test officer	Tester HQ and CD/TD	C+49 (C+27)
6. Revision of TR to address agency comments completed	Test Officer	C+59 (C+34)
7. Final draft TR submitted to tester HQ for typesetting	Test Officer	C+61 (C+35)
8. Copy of camera-ready TR returned to tester for final review	Tester HQ	C+71 (C+45)
9. Camera-ready TR and any final comments returned to Tester HQ for final processing	Test Officer	C+74 (C+47)
10. TR results briefing to tester commander (may include CD/TD representatives)(not required for CEP/CT)	Test Officer	C+75 (NONE)
11. Complete TR revision and submit final draft TR to tester commander for approval	Test Officer	C+77 (C+49)
12. TR approved by tester commander (final version of TR)	Tester HQ	C+79 (C+50)
13. Approved TR published and distributed	Tester HQ	C+85 (C+60)

Figure 6-9. Milestone dates for TR for FDTE and for CEP and CT

DATA RETENTION GUIDANCE

Data Category	Subcategory	Retention/ Review Period*	Storage/Media Accessibility
D. Raw Data. Data in its original form.	D.1 Exposed film and original video tapes. D.2 Original instrumentation tapes or printouts. D.3 Completed data collection sheets and questionnaires. D.4 ...	Not stored if Level 2 data has been developed from it and is available; otherwise, retain until report published.	Retain in original form (off line).
V. Audio/Video Tape and Film.	V.1 Labeled audio or video tape or film. V.1.a ... V.1.b ... V.2 Edited audio or video tape of film.	4 yrs/2 yrs.	As recorded (off line). Digital optical media should be considered for retention of 4 yrs or longer.
I. Processed and Smoothed Automated Instrumentation Data.	I.1 Position/ location. I.2 Line of sight. I.3 Data bus. I.4 ...	10 yrs/2 yrs.	Tape or digital optical media.
A. Automated Test Data Base of Record.	A.1 Data base. A.2 Data base dictionary. A.3 Programs which build data base. A.4 ...	10 yrs/2 yrs.	Tape or digital optical media.

Figure 6-10. Data retention guidance

W. Written Level 2 and Level 3 Data.	W.1 Corrected manual forms. W.2 Logs, transcripts, printouts. W.3 Reduced manual data.	W.1 1 yr/2 yrs. W.2 4 yrs/2 yrs. W.3 4 yrs/2 yrs.	Paper (off line). Digital optical media should be considered for retention of 4 yrs or longer.
R. Plans, Reports, and Analysis.	R.1 Plans, reports. R.2 Analysis programs. R.3 ...	R.1 Permanent. R.2 3 yrs/2 yrs.	R.1 Digital optical media. (Paper copy of report to DTIC required.) R.2 Tape or digital optical media.

* Minimum retention period and maximum period between subsequent reviews.

Figure 6-10. Data retention guidance (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS

FORMAT

FRONT COVER

APPROVAL PAGE

DISCLAIMER FOR TRADE NAMES (if required)

REPORT DOCUMENTATION PAGE, STANDARD FORM 298

EXECUTIVE SUMMARY

I. PURPOSE. Succinctly state the purpose of any evaluation, assessment, or user test reported in the document. This paragraph is an abridgement of paragraph 1.1. in chapter 1 of this report.

II. BACKGROUND. Summarize necessary background information contained in paragraph 1.3. in chapter 1 of this report. Include information on previous tests that may have an impact on understanding the test, evaluation, assessment, or decision.

III. SYSTEM DESCRIPTION (For TR this paragraph should be titled "Description.") Summarize pertinent system or product description information contained in paragraph 1.4. in chapter 1 of this report. Include only sufficient information to identify the system under discussion and to explain its role and its missions within the Army branch functional areas.

IV. TEST CONDUCT (For OA/EOA which do not include user testing, this paragraph should be titled "DATA SOURCES," see paragraph b. below.)

a. **IV. TEST CONDUCT.** Do not use for OA/EOA with no user test. This paragraph covers the what, where, when, and how of the test. Provide specifics that show the extent of the test, as to duration of the test, number of trials, number and types of crews, and overall conditions. Give the location and dates of the test and who conducted it. Provide a brief description of the test execution. Summarize details from the scope, general methodology, and test execution in chapter 2 of the TER.

Figure 6-11. Detailed guidance for development and documentation of reporting documents

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. **IV. DATA SOURCES.** Use only for OA/EOA with no user test. This paragraph covers the data sources used to conduct the assessment and prepare the OA/EOA. Summarize details from chapter 2 of the OA/EOA. Provide specifics that show the extent of the test (model, simulation, study, etc.) and the location and dates of the effort and who conducted it.

V. TEST AND EVALUATION LIMITATIONS AND IMPACT (For TER (AE) or TR this paragraph should be titled "Test Limitations and Impact"; for OA/EOA after EUTE, LUT, or abbreviated FOT use the title "Test and Assessment Limitations and Impact"; and for OA/EOA with no user test "Assessment Limitations and Impact.")

a. List both the limitations for the conduct of the user test (if any) and the limitations on the evaluation/assessment (except in TER (AE) and TR). List all the limitations if the number is small. If the number is large, list the major limitations in this paragraph and cover all of the limitations in paragraph 1.7. of the report.

b. Include a statement that no limitations existed, if applicable.

VI. OPERATIONAL EFFECTIVENESS SUMMARY (Title this paragraph "Conclusions" for TR of FDTE, CEP, and CT.) Present significant results and the evaluation/assessment/analysis summary that will address that portion of the operational issues that contribute to operational effectiveness of the system or product.

VI.1. Issue Summary. Copy each issue statement from paragraph 1.5. in chapter 1 of this report. This is a summary of chapter 3 of this report.

VI.1.1. Issue 1. This is the first issue from paragraph 1.5. of this report. State the issue as written in the TEP, then provide a narrative as to how the answers to the issue contribute to operational effectiveness (effectiveness in the TR) of the system or product. Provide the significant results from all data sources and the writer's assessments of the issue based on the results.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

VI.1.2. Issue 2. This is the second issue from paragraph 1.5 of this report.

(through)

VI.1.n. Issue n. This is the n-th issue from paragraph 1.5 of the TER.

VI.2. Overall Operational Effectiveness Assessment (Title this paragraph "Overall Assessment" for a TR.) This is a summary of paragraph 4.1. of the report.

VI.3. Operational Effectiveness Recommendations (Title this paragraph "Recommendations" for a TR.) This paragraph is not used for TER (AE). This is a summary of the operational effectiveness portion of paragraph 4.1. of the report (paragraph 4.2. of a TR).

VII. OPERATIONAL SUITABILITY SUMMARY. This paragraph is not used for a TR of FDTE, CEP, or CT. Present the major results and the evaluation/assessment/analytic summary that will address that portion of the operational issues that contribute to operational suitability.

VII.1. Issue Summary. Copy each issue statement from paragraph 1.5. of this report. This is a summary of chapter 3 of this report.

VII.1.1. Issue 1. This is the first issue from paragraph 1.5. of this report. State the issue as written in the TEP, then provide a narrative as to how the answers to the issue contribute to operational suitability of the system. Provide the significant results from all data sources and the evaluator assessments of the issue based on the results.

VII.1.2. Issue 2. This is the second issue from paragraph 1.5. of this report.

(through)

VII.1.n. Issue n. This is the n-th issue from paragraph 1.5. of this report.

VII.2. Overall Operational Suitability Assessment. This is a summary of paragraph 4.2. of this report.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

VII.3. Operational Suitability Recommendations. This is a summary of the operational suitability portion of paragraph 4.3. of this report. This paragraph is not used in an TER (AE).

VIII. RECOMMENDATIONS FOR FUTURE OTE. This paragraph is not used for an TER (AE) or a TR for FDTE, CEP, or CT. Summarize the recommendations contained in paragraph 4.3.2. of the report.

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BODY OF REPORT

CHAPTER 1. INTRODUCTION.

a. The tester leads in the preparation of this paragraph for TER with input by the evaluator. The tester prepares this chapter for TER (AE) and TR. The evaluator prepares this chapter for OA/EOA with no user test.

b. This chapter provides necessary information to understand the bases of both the test and of the evaluation. The writer will extract and update material as necessary from chapter 1 of the approved TEP to complete the paragraphs for this chapter.

c. The tester and evaluator should complete most of this chapter when they begin the strawman report.

1.1. PURPOSE.

a. This paragraph states the purposes for conducting the evaluation or assessment of the test as it relates to the program acquisition strategy and structure. Identify MADP milestone or other decision supported by the evaluation or assessment.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. The paragraph should be a succinct statement of the purpose of the evaluation or assessment and the supporting user test. Use the purpose statement from the TEP as a guide and update it using the past tense.

1.2. SCOPE.

a. This paragraph addresses the breadth of the data sources used to prepare this TER, OA, or EOA. Provide an overview of relevant models, analyses, tests, equipment, and other resources that together are the basis for the evaluation or assessment. The scope also addresses the depth of evaluation or assessment of both operational effectiveness and suitability.

b. For full-evaluate systems, the scope of the evaluation or assessment will include information on all the User Tests, Technical Tests, modeling and simulation, and studies that provided information for the evaluation or assessment. Use the scope paragraph from the TEP as a guide and update it using the past tense. The data source matrix in the TEP provides the outline for the scope of the TER. Describe the test(s) identified in the system TEMP and TEP covered by this report.

c. The EOA for a Milestone II will typically assess specific system capabilities and potential for maturation.

d. The OA for a LRIP Release Decision will typically assess operational effectiveness and suitability and readiness for LRIP and IOT.

e. The TER for a Milestone III will typically evaluate operational effectiveness and suitability and support the full-scale production decision.

f. For AE systems and TR, use the scope paragraph in the TEP as a guide and update it using the past tense. Combat and training developers may conduct evaluations or assessments in support of their products.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

1.3. BACKGROUND. This paragraph includes the background of the system development and the test and evaluation of the system. For TR for FDTE, CEP, and CT, this paragraph includes the background of the system or combat/training development product and the previous testing of the system/product.

1.3.1. PROGRAM BACKGROUND. Use the Program Background paragraph from the TEP as a guide and update it using the past tense. Include an overview of the program and its acquisition strategy or the combat or training development and its planned implementation. State the anticipated use to the Army and deficiencies that the system/product corrects. State the next program decision point (or CD/TD equivalent) supported by the testing and evaluation and the required decision from that meeting (i.e., enter next acquisition phase, low rate initial production, full-scale production, fielding). Identify deficiencies or suitability and effectiveness problems existing in similar systems/products, as well as the test and programmatics used to evaluate those systems/products.

1.3.2. TEST AND EVALUATION BACKGROUND. This paragraph includes a summary of all operational, technical, contractor, and other user (FDTE, CEP, CT) test and evaluation to date. Include both the scope and the results of the test and evaluation.

1.3.3. COEA/OTE RELATIONSHIP. Required for any system for which a COEA is done and OTE is conducted. Describe the linkage between the COEA and the results of OTE. The description of the linkage should explain how the MOEs and MOPs used for OTE are consistent with the criteria in the COEA, which in turn should have MOEs and MOPs consistent with the operational requirements document (ORD), the TEMP and the Acquisition Program Baseline (APB).

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

1.4. SYSTEM DESCRIPTION (Title this paragraph "Description" for TR of FDTE, CEP, and CT.)

a. This paragraph includes a description of the materiel or IMA system or the combat/training developments product. It should describe the system/product and its major roles, missions, and components or characteristics. A description of similarities and differences between the system or product under test and the objective system or product under development is appropriate here. Summarize the concept for force structure and employment in this paragraph.

b. Use the description paragraph from the TEP as a guide and update it using the past tense. If the details are so voluminous that continuity of the TER is lost, they should be summarized here and stated in detail in appendix G. Appendix G is optional if the details can be adequately covered in this paragraph.

1.5. OPERATIONAL ISSUES AND CRITERIA (OIC).

a. This paragraph lists the operational issues and their associated criteria used to evaluate, assess or analyze the system and that were the basis for constructing the evaluation, assessment or analytic plan and developing the test design for the system or for the combat or training developments product. The OIC listed here are those OIC, both critical and additional, stated in the TEP. State the full issue, scope, criteria, and rationale.

b. For materiel and IMA systems, the OIC will be broken down into COIC (prepared by the combat developer or functional proponent) and AOIC prepared by the evaluator. The COIC and the AOIC collectively constitute the OIC for evaluation, assessment, or analysis. For test of combat or training developments products, OIC are developed and stated by the combat developer, training developer, or functional proponent, as appropriate.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

1.5.1. CRITICAL OPERATIONAL ISSUES AND CRITERIA (COIC).

a. This paragraph contains the approved COIC which are directly extracted from the approved TEP. The critical operational issues address key operational questions about a system which must be addressed for the next milestone decision. The emphasis of critical issues is on determination of the attainment of certain key performance levels and on surfacing potential problems which could interfere with a successful acquisition.

b. Each COIC set is stated in full to include issue, scope, criteria, and rationale. The evaluator may have added additional evaluator criteria to a critical issue. Criteria which are a part of the original COIC set will always have both a measure (parameter) and a threshold (value). Criteria developed by the evaluator may have only a measure (parameter) specified.

c. Subparagraph organization is as follows:

1.5.1.1. COIC 1 Issue Statement
1.5.1.1.1. COIC 1 Scope
1.5.1.1.2. COIC 1 Criteria
1.5.1.1.3. COIC 1 Rationale
1.5.1.2. COIC 2
through
1.5.1.m. COIC m

1.5.2. ADDITIONAL OPERATIONAL ISSUES AND CRITERIA (AOIC).

a. This paragraph contains the AOIC developed by the evaluator to complement and supplement the approved COIC to completely address all aspects of system operational effectiveness and suitability. The approved AOIC are directly extracted from the approved TEP. The AOIC address operational questions about a system which must be addressed for a complete operational evaluation or assessment to be made about a system. The emphasis of AOIC issues is on determination of the attainment of all performance levels and on surfacing potential problems which could affect the acquisition.

b. Each AOIC set is stated in full to include issue, scope, criteria, and rationale. Criteria developed by the evaluator may have only a measure (parameter) specified.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

c. Subparagraph organization is as follows:

1.5.2.m+1. AOIC m+1 Issue Statement
1.5.2.m+1.1. AOIC m+1 Scope
1.5.2.m+1.2. AOIC m+1 Criteria
1.5.2.m+1.3. AOIC m+1 Rationale
1.5.2.m+2. AOIC m+2
through
1.5.2.n. AOIC n

1.6. EVALUATION APPROACH (Title this paragraph as "Assessment Approach" in all OA/EOA; "Analytic Approach" in all TER (AE) and TR.)

a. This paragraph summarizes the overall approach to the evaluation of the system. Show the methodologies by which the answers to the issue questions were further analyzed and consolidated to draw conclusions on the overall operational effectiveness and operational suitability of the system.

b. Include in this paragraph the overall evaluation, assessment, or analytic approach as stated in paragraph 2.1 of the TEP. Include references to the data source matrix and the purpose of other tests conducted in support of the evaluation/assessment/analytic plan as applicable.

1.7. TEST AND EVALUATION LIMITATIONS AND IMPACT (Title this paragraph "Test Limitations and Impact" for TER (AE) and TR; "Test and Assessment Limitations and Impact" for OA/EOA after EUTE, LUT, and abbrev FOT; and "Assessment Limitations and Impact" after OA/EOA with no user test.)

1.7.1. TEST LIMITATIONS AND IMPACT (Number this paragraph 1.7 for TER (AE) and TR.)

a. This paragraph is prepared by the tester and states the limitations that prevented complete test execution, impacted the collection of data, or affected the data collected. Describe uncontrolled variables not discussed above. Describe variables over which the tester had no control (e.g., player morale, leadership, weather) and the impact of each on the test.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. List all limitations that had an impact on test design and test conduct. Describe all known limitations to the adequacy of the test (e.g., duration, number of systems, test unit availability, availability of interoperable systems, and instrumentation) and their impact on the operational test measures of performance (OTMOPs).

c. List any deviations from the TEP, why they occurred, and the impact they had on the test.

1.7.2. EVALUATION/ASSESSMENT LIMITATIONS AND IMPACT (Number this paragraph 1.7 for OA/EOA with no user test.)

a. This paragraph is prepared by the evaluator and states the known limitations of the evaluation and those data sources (to include the operational test) which supported the evaluation. These limitations are to be presented and discussed in terms of their impact on the evaluation. This will include an explanation of why the limitations existed, which COIC/AOIC were impacted, and what was done to minimize their impact.

b. List all limitations that had an impact on the data and, therefore, on the evaluation. List the impact on the evaluation or assessment of any deviations from the TEP.

CHAPTER 2. TEST DESCRIPTION.

a. For OA/EOA with no user test, chapter 2 is a one line statement to the effect that no dedicated user test was planned or conducted to support the OA/EOA.

b. The basic format for chapter 2 in all cases other than that mentioned above is as follows. The tester prepares all of the paragraphs in this chapter. This paragraph describes the test conducted to address the operational issues, OTMOP, and data requirements specified in the TEP.

c. Use appendixes only as necessary where the material is too voluminous to include in this paragraph without breaking the logical flow of information. Whenever using an appendix, provide a brief summary of the information within this chapter.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

d. For some FDTE, CEP, and CT supporting combat/training development products, all paragraphs may not apply. If a paragraph is not applicable to this test, so state.

2.1. TEST PURPOSE. State the test purpose from the approved outline test plan (OTP) or Resume Sheet (RS) for the test. This paragraph contains the purpose of the test and proposed usage of the results. This will be the same as the test purpose contained in the TEP.

2.2. AUTHORITY TO CONDUCT TEST. State the specific TEMP and approved 5-year test plan (FYTP) authorizing the conduct of test, and reference the DA memorandum approving the current FYTP and the number of the approved OTP or RS for the test.

2.3. TEST OVERVIEW.

a. Provide a general overview of the test execution, to include when, where, general description, and test variables. Refer to chapter 2 of the TEP where the evaluator described the concepts guiding the design and execution of the test.

b. Specify the test phases (e.g., pilot test, record trials, live firings, field training exercises (FTXs), command post exercises (CPXs), demonstrations) making up the test and summarize test conditions and events making up each phase. Describe use of any baseline system in testing. Include descriptions of execution procedures, control procedures, and any other information needed to understand the matrix(es) that are applicable to all issues.

c. Information on limitations inherent in the test concept, to include baseline limitations, are suitable for inclusion. Provisions to ensure that test events adhered to the operational mode summary or mission profile are to be included.

d. Provide a statement regarding test duration and number of operating hours, miles driven, and iterations per condition.

2.4. CONDUCT OF TEST. Describe the conduct of the test in terms of its tactical context, events, control, phasing, scheduling, and methodology.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

2.4.1. TACTICAL CONTEXT. Describe the tactical context and associated scenario(s) (e.g., Middle East, European), environment, threat, tactics, and doctrine used in each test phase.

2.4.1.1. SCENARIO(S).

a. Summarize the tactical scenario(s). State the type of tactical situation used in the test. The scenario description consists of the geographic portrayal of the area, forces, and events of a hypothetical armed conflict.

b. The combat developer provides standard scenarios as part of the doctrinal and organizational (D&O) support package. The scenarios provide a common framework of selected situations and real world conditions in which specified test events are set for the Middle East, Europe, Alaska, Korea, Persian Gulf, etc.

2.4.1.2. TEST ENVIRONMENT.

a. Describe the environmental conditions such as the type of terrain, climate conditions, and conditions of the test area. Describe the use of test site terrain for each phase, scenario, mission, or trial.

b. The tester discusses the balance between realistic representation of the operational environment and those conditions required to occur during programmed test events. He describes the play of electronic warfare (EW), obscurants, NBC, level of conflict intensity, mission profiles, and environmental factors.

2.4.1.3. THREAT FOR TEST.

a. To comply with AR 381-11, a test must have used an approved threat. Testing must include an accurate representation of the threat projected to exist IOC+ (initial operational capability +).

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. Use the threat paragraph from the TEP as a guide and update it using actual threat force organization, strength, and doctrine portrayed in the test. Explain where differences between the planned and actual portrayed threat occurred. Attempt in this paragraph to complete an accurate description of the threat as portrayed in the test and avoid adding a threat appendix.

c. The tester describes play of the threat systems and tactics for each phase. Reference the threat support package and the system threat assessment report (STAR) to describe the opposing forces (OPFOR) tactics and define the threat weapons employed and the size and type of the force.

2.4.1.4. TACTICS AND DOCTRINE.

a. This paragraph describes the friendly tactics and doctrine to be played in each phase. The phases are designed within the tactical and doctrinal framework of the D&O support package.

b. The tester defines how the framework was realized on the ground within the environment of the test. He also describes the degree of test player free play allowed within the framework.

2.4.1.5. FRIENDLY (PLAYER) FORCES.

a. Describe friendly forces used and types of units involved in the test. Do not specifically name a designated unit. Provide data on test player forces that operated the system and portrayed the supporting, supported, and adjacent forces in play.

b. Discuss organization of the unit and describe any significant requirements. Include additional information such as TOE designation, if applicable.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

2.4.2. TEST EVENTS.

a. This paragraph should include discussions of the organization and overall layout of the test to include sequence of phases. Use flow diagrams, time lines, and matrixes as appropriate to introduce the events described.

b. Test events are described as data requiring occurrences (such as a helicopter unmasking from a predetermined location and attempting to acquire targets quickly in a tactically deployed array). Test trials may consist of many events which occur under different tactically varied conditions within the trial (for example, a free-play force-on-force exercise).

c. A test trial is a continuous tactical exercise beginning from systematically controlled initial conditions and evolving tactically within some controlled bounds until meeting some specified duration or objective. A test trial is the smallest test planning unit scheduled to occur under specific conditions at a specific time. Test trials are made up of test events.

d. Scenarios, missions, or vignettes are built up from scheduled trials and may stretch out for relatively long periods (for example, testing of an infantry weapon through multiple 72-hour field exercises).

e. Test phases are periods of time within which similar scenarios are conducted, possibly on ranges separated by substantial distances (such as force-on-force phase versus live-fire phase). Phases usually represent the largest breakdown of the test.

f. Describe the test phases and schedule of test events as executed during the test. An operational test can be composed of a training phase, pilot test, several scenario driven phases, and specific exercises or excursions. The tester defines the test and, for each phase or stratification of the test, specifies what was included and how it was accomplished. Identify locations by phase when using different locations for specific phases. Include tables for event matrixes providing information on the major events conducted during the test to include number, type and conditions (light, mission-oriented protective posture (MOPP), countermeasures).

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

2.4.3. CONTROL PROCEDURES.

a. This paragraph includes descriptions of the control structure and procedures used to ensure that required test events occurred in situations that realistically depicted the tactical context of the test in accordance with the operational mode summary (OMS).

b. Summarize the control procedures. State if conduct of the test was on a free-play basis or if individuals such as umpires, control officer, or operations officer administered control of the test. Summarize the uncontrolled variables over which the tester had no control such as player morale, leadership, or weather, and the impact of each on the test.

2.4.4. SCHEDULE OF EVENTS. Overall test schedule. This information may appear in a figure or table referred to in this paragraph.

2.4.5. OVERALL METHODOLOGY.

a. This paragraph may not be necessary if methodology is fully covered under each issue in chapter 3 below. When using this paragraph, it should be a consolidation of methodology that applies to all the issues. This methodology paragraph should be the same as the overall methodology paragraph in the TEP except changing the verbs to past tense and updating the text to describe the test events, conditions, and methods actually used in conducting the test.

b. State both the overall methodology for the test and the methodology common to more than one issue. State issue specific methodology in chapter 3. As appropriate, update methodology information contained in the TEP.

c. This paragraph should include descriptions of execution procedures, control procedures, data collection procedures, and any other information necessary for an understanding of the matrix that applies to all issues. Include information on assumptions, limitations, or advantages inherent in the test concept.

d. Describe the necessity for testing with a baseline system, if applicable.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

2.5. TEST DATA MANAGEMENT. Provide the concepts used for data management and the contents of the tester data base.

2.5.1. DESCRIPTION OF DATA COLLECTION METHODS. Describe the manual and instrumentation methods used for the collection of test data. Address use of instrumentation, manual observation methods, or judgmental or subjective evaluation to collect data. Describe provisions for quality assurance of the data.

2.5.2. DATA BASE.

a. Summarize the responsibilities of the Data Authentication Group (DAG), if formed. State what offices made up the DAG. Describe the types of data produced during the test. Summarize how the DAG examined the data.

b. Provide a general description of the data base and include a sentence stating the completion date of data base validation by the DAG. FDTE, CEP, and CT will not normally require a DAG.

c. When test data are extensive enough to require storage in an automated data base, the structure and content of the data base is briefly described in this section and described in detail in appendixes A, B, and C. The architecture and design of the data base are described including the relationships among files and records.

2.6. TRAINING CONDUCTED. Summarize the training provided to and conducted for or by the player and threat forces or units. Identify the source for training provided to the units. Also summarize the training conducted for the test organization personnel, data collectors, and data reducers. Include a sentence that states the date of the trainer operational test readiness statement (OTRS) and any other pertinent documents pertaining to training of personnel.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

2.7. INSTRUMENTATION, TARGETS, AND THREAT SIMULATORS (ITTS).

a. The tester should briefly describe ITTS used in test, other than that used for data collection. Describe the purpose of the ITTS used and provide information on how it operated during the test. Identify decision authority and documentation approving any ITTS used in the test.

b. Instrumentation consists of electronic devices and systems designed to collect, process, and document test event data. Include discussions of the following:

(1) Video instrumentation.

(2) Existing instrumentation systems used, such as range measuring system (RMS), TEXCOM Automated Field Instrumentation System (TAFIS), voice recording system (VRS), scanning laser system (SLS), and electro-optics.

(3) Design and construction of new instrumentation devices or modification of existing instrumentation devices/systems required.

(4) Simulators, stimulators, emulators, and drivers (SSED) for computer driven systems.

c. When applicable, this paragraph describes the use of existing and new targets and threat simulators.

2.8. ENVIRONMENTAL AND ENERGY IMPACTS. Include, as the last sentence of this subparagraph, the following statement: "The environmental and energy impacts of this test (were) (were not) considered significant." If applicable, address the environmental and energy impact resulting from using a system during the test or of the test as a whole. If the data are voluminous, place them in an appendix and refer to the appendix here.

2.9. TEST OFFICER'S OBSERVATIONS. Include observations of knowledgeable individuals (e.g., testers, project officers, behavioral scientists, or engineers) in this paragraph. Base the information contained in this paragraph on observations as well as test data. Observations do not necessarily have to be supported by test data.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

CHAPTER 3. TEST AND EVALUATION RESULTS. (Title this paragraph "Test and Assessment Results" for OA/EOA; "Test and Analytic Results" for TER (AE) and TR.)

a. This chapter is the most important chapter in the report. This chapter establishes test results, analyses of test data, and evaluative/analytic findings. It should be a thorough description of the test data and analytic results keyed to the issues, criteria, and MOE/MOP from the TEP.

b. For full-evaluate systems the evaluator writes this chapter with the assistance of the System Task Force (STF) to include the tester and test analysts. For TER (AE) and TR, the tester writes this chapter.

3.1. ISSUE 1. This is a restatement of the first operational issue from paragraph 1.5. in chapter 1.

3.1.1. CRITERION 1.1. This is the first criterion for the issue as stated in the TEP.

3.1.1.1. MOE/MOP 1.1.1. Use the MOE/MOP as stated in the TEP. The tester will support and provide much of the information to complete paragraphs 3.1.1.1.1 through 3.1.1.1.n.

3.1.1.1.1. SPECIFIC METHODOLOGY.

a. The tester will prepare the information to complete the methodology paragraph.

b. Describe how data pertaining to the MOE/MOP were generated, collected, and reduced. Explain significant deviations from test methodology described in the TEP and reasons for not addressing any required MOE/MOP.

c. If the methodology becomes redundant, place this methodology in the overall methodology paragraph 2.4.5.

3.1.1.1.2. DATA (Level 4 Summary Statistics).

a. The tester will assist the evaluator in the completion of the level 4 data reduction and in the analysis and discussion of the data results (the tester writes this paragraph for TER (AE) and TR).

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. Use tabular, graphic or other appropriate formats to show the descriptive statistics information pertaining to the data collected for the MOE/MOP. Show the source of the data (e.g. OT, FDTE, TT, Contractor Testing, Model, Simulation, Study, Analysis).

c. If the MOE/MOP requires multiple data sources, use a separate subparagraph for each data source. List data from the user test reported in the TER/OA/EOA first. List data from other data sources in order of importance after the user test data (TER (AE) and TR will have no other data).

(through)

3.1.1.1.n-1.

3.1.1.1.n. ANALYSIS AND DISCUSSION.

a. Provide information that will increase the understanding of the summary statistics data. For example, discuss how conditions existing during the test may have impacted on the collection or validity of the data and the impact of the conditions on the results.

b. Provide confidence levels for numerical results. Use levels 5, 6, and 7 data to provide analyses.

3.1.1.2. MOE/MOP 1.1.2.

(through)

3.1.1.n. MOE/MOP 1.1.n.

3.1.1.n+1. CRITERION 1.1. FINDINGS AND DISCUSSION.

a. Provide a discussion on how the system performed in relation to the criterion and to each of the MOE/MOP. Include any statistical test results, analysis or other information pertaining to the performance. State whether the system met or did not meet the requirements of the criterion.

b. Include any discussion of the operational significance of the finding. Explain how the results of the MOE/MOP were evaluated in determining the finding for the criterion.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

3.1.2. CRITERION 1.2. This is a statement of the second criterion for the issue.

(through)

3.1.n. CRITERION 1.n. This is a statement of the last criterion for the issue.

3.1.n+1. ISSUE ANALYSIS AND DISCUSSION. This paragraph contains any discussion, statistical testing and analysis pertaining to the operational issue considering all criteria, but not addressed above for any of the specific criterion.

3.1.n+2. ISSUE EVALUATION AND CONCLUSIONS. This paragraph contains the evaluation for the issue, to include evaluator (tester for TER (AE) and TR) conclusions and answer to the issue question.

3.2. ISSUE 2. This is a restatement of the second issue from paragraph 1.5.

(through)

3.n. ISSUE N. This is a restatement of the last issue from paragraph 1.5.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

CHAPTER 4. OVERALL CONCLUSIONS AND RECOMMENDATIONS (Title this paragraph "Overall Conclusions" for TER (AE).)

a. The following basic format is to be used for all documents except TR of FDTE, CEP and CT. For TR of FDTE, CEP, and CT, an alternate format (see paragraph b. below) is used. The operational evaluator prepares this chapter for all full evaluate systems. The tester assists the evaluator as a part of the STF. The tester prepares this chapter for AE systems.

4.1. OPERATIONAL EFFECTIVENESS CONCLUSIONS (Title this paragraph "Operational Effectiveness Assessment" for OA/EOA.)

(1) This paragraph should emphasize overall operational effectiveness based on the findings in chapter 3 as tempered by the considered military judgment of the evaluator (tester for AE).

(2) Present the significant results and the evaluation summary that will address that portion of the operational issues that contribute to operational effectiveness.

(3) Include combinations of issue conclusions considering mission, need current and projected threat, trade-offs, planned improvements, and potential product improvements.

(4) Address adequacy of supporting data. Present a position on the future capability of the system to fulfill the approved requirements. Summarize consequences of fielding, including risks, burden, and comparison to replaced system as appropriate.

(5) Also include key technical evaluation findings that supplement or support the operational findings or which present significant information.

(6) For all OA/EOA use appropriate wording in the paragraph to show that the evaluator is assessing progress toward effectiveness requirements or goals.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

4.2 OPERATIONAL SUITABILITY CONCLUSIONS (Title this paragraph "Operational Suitability Assessment" for all OA/EOA.)

(1) This paragraph should emphasize overall operational suitability based on the findings in chapter 3 as tempered by the considered military judgment of the evaluator (tester for AE).

(2) Present the significant results and the evaluation summary that will address that portion of the operational issues that contribute to operational suitability. Include combinations of issue conclusions considering mission, need, current and projected threat, trade-offs, planned improvements, and potential product improvements.

(3) Address adequacy of supporting data. Present a position on the future capability of the system to fulfill the approved requirements. Summarize consequences of fielding, including risks, burden, and comparison to replaced system as appropriate.

(4) Also include key technical evaluation findings that supplement or support the operational findings or which present significant information.

(5) For all OA/EOA use appropriate wording in the paragraph to show that the evaluator is assessing progress toward suitability requirements or goals.

4.3. RECOMMENDATIONS. This paragraph is not used in a TER (AE).

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

4.3.1. SYSTEM DESIGN IMPROVEMENTS. Base this paragraph on shortfalls of the system and the future capability of the system to fulfill the approved requirements. This paragraph includes the evaluator recommendations for fixes needed before the next milestone, planned improvements, and potential product improvements. Include evaluator suggestions for improvements to the system design, doctrine, tactics, organization, and training.The evaluator should state his recommendations in terms of "what needs to be fixed" rather than "how to fix it" which is the mission of the MATDEV (CBTDEV/TNGDEV).

4.3.2. FUTURE TEST AND EVALUATION.

(1) Based on the adequacy of this test and evaluation and on system performance, the evaluator recommends issues to address in subsequent studies or testing. Plan for follow-on actions to ensure correction of identified limitations.

(2) Include summary of planned product improvements and the test and survey data to verify success of fixes.

b. The following alternative format for this chapter is to be used by the tester in preparing TR for FDTE, CEP, and CT.

4.1. OVERALL CONCLUSIONS.

(1) Present the significant results and the analytic summary that will address the issues. Include combinations of issue conclusions considering mission, need, current and projected threat, trade-offs, planned improvements, and potential improvements. Address adequacy of supporting data.

(2) Present a position on the future capability of the system/product to fulfill the requirements or need. Summarize consequences of fielding or implementation, including risks, burden, and comparison to replaced system/product as appropriate.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

4.2. RECOMMENDATIONS. Base this paragraph on shortfalls of the system/product and the future capability of the system/product to fulfill the approved requirements/needs. This paragraph includes recommendations for fixes needed, planned improvements, and potential improvements. Include suggestions for improvements to materiel, doctrine, tactics, organization, and training.

APPENDIXES.

a. The appendixes to the report provide copies of supporting documentation, provide administrative listings, and expand report paragraphs into detailed descriptions. The purpose of the appendixes is to provide complete information to the reader, yet avoid interruptions in the logical flow of information in the main body of the document due to incorporation of too much detail.

b. For this reason, many of the appendixes are optional. Use these appendixes only if the information in the particular paragraph of the report is of sufficient volume and complexity to interrupt the logical flow of information.

c. The instructions for each individual appendix identify the writer of that appendix for each type of report. If an appendix is not used, show that by a place holder. Do not redesignate appendixes.

APPENDIX A. DATA BASE STRUCTURE AND DATA BASE.

a. The tester always writes this appendix. This appendix contains the detailed description of the structure and contents of the level 3 data base for the user test. It also serves to transmit the level 3 data base to interested parties of the acquisition team and approved Army and DOD agencies. This appendix is not used for OA/EOA with no user test.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. The data base structure and data dictionary are the core of the data base description in the test and evaluation report. The structure of the data base is to be described in detail in the appendix. The description should include identification of each file in the data base, the relationship to other files, and contents. Key variables which link files should be identified. The description of the file contents should include, as a minimum, the file identification, the software type or format of the file (i.e., ASCII (flat), SAS, DBASE#, etc.), listing of each variable in the file (to include name, description, type, values, etc.), and total number of records contained.

c. The data in each file or record are to be listed and augmented by any necessary definitions. Good data definitions specify exactly what is measured when. Examples are:

(1) "Elapsed time to transmit a call is to be measured and recorded to the nearest second by a data collector at the transmitter using a stopwatch. Transmission time begins when the operator ... <specify operator action> and ends when ... <specify operation>."

(2) "RMS display range is the RMS range between the aircraft and the ground target at the time when the 1553 data bus in the aircraft confirms that the ground target symbol is displayed on the aircraft gunner's scope. This is available from the RMS instrumentation system."

d. Provide data base structure diagrams which expand on data base descriptions. Provide a crosswalk of data elements and the data collection forms on which these data elements were collected.

e. The actual level 3 data base can be included in the appendix if the data base is not too voluminous. If the data base is included in the appendix, it should be no more than 30 pages of data. However, because most of the data bases are not small, the data base should be provided as a magnetic medium such as computer disks or tapes. The appendix should then contain an inventory of the number, type, and contents of each tape or disk with appropriate instructions for use.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

f. All tapes or disks provided should be adequately labeled for reference. If the data base is not provided to all agencies on the distribution list, include a statement that the complete, unabridged data base is available upon request and the method and address (telephone number) for making the request.

g. The contents of the appendix will address (include or provide on disk/tape) all level 3 data needed to support the report. To assist readers in locating and reviewing information contained in the appendix, the preparer should group the information by related material in separate paragraphs or sections.

h. Summary (level 4 or higher data).

(1) For full-evaluate systems, normally no summary data will be provided in the appendix. In the case when the test agency decides that a need exists to highlight a selected category or specific item of data, summary tables of data at no greater than level 4 can be developed and included in the appendix. Care should be exercised to ensure that the tester has coordinated the data summary with the operational evaluator prior to inclusion. Such tables should not duplicate information to be included in chapter 3.

(2) For abbreviated evaluate systems and other user tests, data summaries to supplement or complement the results contained in chapter 3 may be included. Efforts should be made to reduce such summaries to a minimum.

(3) Include examples of data forms and summaries of responses to questionnaires and interviews only when pertinent to a clear understanding of the analyses, findings, or assessments.

APPENDIX B. SUPPLEMENTAL USER TEST DATA.

a. The tester always writes this appendix. Include user data that does not fit into the data base (e.g., photos, videotapes, audiotapes, interviews). This appendix is not used for OA/EOA with no user test.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

b. The tester may combine this appendix with appendix A for a simple test. If the data are too voluminous, the test officer may consider summarizing and cataloging the data in this appendix. If the data are not published as part of the report, include a statement as to data being available upon request by interested agencies.

c. Identify photographs and illustrations by figure numbers and captions and place them in the report as soon as possible after first mentioned. Use high-quality photographs, diagrams, and illustrations to depict test conditions and clarify reports.

d. Use arrows to indicate points of interest in photographs and illustrations. Use a scale or some other means in photographs, when necessary, to aid the viewer in getting the proper perspective or size of the test system or item. Obscure trade names and manufacturers' names on tested items in such photographs.

APPENDIX C. RAM DATA, COMPUTATIONS, AND SCORING CONFERENCE MINUTES.

a. The tester writes this appendix with input from the evaluator for full-evaluate system tests (except for OA/EOA with no user test where it is written by the evaluator). This appendix is prepared in total by the tester for TER of abbreviated evaluate systems and for TR of FDTE, CEP, and CT in which RAM data are collected.

b. User testing will assess the RAM performance characteristics upon exposure of the materiel or software to a variety of expected operational conditions. The scope of the RAM testing will vary depending on the type of test or the test phase conducted.

c. The data forms, charts, maintenance records, or other RAM data that are too voluminous or extensive for inclusion in the main body of the report and are deemed necessary for understanding of the RAM area will be placed in this appendix.

d. Include the results of the OT scoring conference(s) in this appendix. Listings of the score of each incident report may be included; however, a summary of the number of reports by category of scoring should be provided prior to the listing.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

e. Individual test incident reports (TIRs) will not be placed in the appendix or report.

APPENDIX D. OTHER DATA SOURCES (Title this paragraph "Data Sources" for OA/EOA with no user test.)

a. The evaluator always writes this appendix. This appendix is not used for TER (AE) or TR for FDTE, CEP, and CT.

b. This appendix contains data obtained from technical testing, contractor testing, other user tests (e.g., FDTE), modeling, simulation, market surveys and investigations, studies, and analyses. If the data are simple, include them here. If the data are voluminous, summarize and catalogue the data here and reference where the data can be seen in their entirety.

c. All sources of data to be used in an assessment must be described in the TEP. Each MOE/MOP must be addressed by at least one data source. Any test, model, simulation, market survey, market investigation, study, analysis, or investigation used as a primary or secondary data source for any MOE/MOP must be described in this appendix to permit understanding of the effort. User tests, contractor tests, and technical tests will be described in sufficient detail to provide an understanding of the test.

d. Each separate test and other effort comprising a discrete data source will have its own paragraph in this appendix and the paragraph numbering will be adjusted accordingly (e.g., D.1. FDTE, D.2. TT1, D.3. TT2, D.4. Contractor Test, D.5. COEA Model, D.6. Other Model, D.7. Simulation, D.8. Market Survey).

D.1. TEST NAME (e.g., FDT, FDE, CEP). Use this paragraph to describe another user test used in this assessment, the results of which are reported in a separate document. Repeat this paragraph as necessary for multiple tests. This paragraph varies in scope and complexity depending on the size and sophistication of the test. It provides the basis for understanding the value and context of the data as it applies to this assessment.

D.1.1. TEST SCOPE. Derive the scope from the report or plan of the test in sufficient detail to provide understanding of the data to be used.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

D.1.2. FACTORS AND CONDITIONS. Factors and conditions from the test report or plan are described in sufficient detail to provide a context for the data to be used.

D.2. TEST NAME (e.g., TT, LFT, CONTRACTOR TEST). Use this paragraph to describe a technical test, a contractor test, or any other test, demonstration, or review. The test design will be described in the test plan or report for the test. Repeat this paragraph as necessary for multiple tests. This paragraph varies in scope and complexity depending on the size and sophistication of the test. It provides the basis for understanding the value and context of the data as it applies to this assessment.

D.2.1. TEST SCOPE. Derive the scope from the report or plan of the test in sufficient detail to provide understanding of the data to be used.

D.2.2. FACTORS AND CONDITIONS. Factors and conditions from the test report or plan are described in sufficient detail to provide a context for the data to be used.

D.3. MODEL OR SIMULATION NAME. Use this paragraph to describe a model or simulation which provides data for the assessment. Repeat this paragraph as necessary for multiple models and simulations. This paragraph varies in scope and complexity depending on the size and sophistication of the model or simulation. It provides the basis for understanding the value and context of the data derived from this source. Validation, verification, and accreditation sources and dates for the model or simulation must be listed in this paragraph.

D.4. MARKET SURVEY OR INVESTIGATION NAME. Use this paragraph to describe a market survey investigation which provides data for the assessment. Describe the details of this survey or investigation from the report of the effort. Repeat this paragraph as necessary for multiple surveys and investigations. This paragraph varies in scope and complexity depending on the size and sophistication of the survey or investigation. It provides the basis for understanding the value and context of the data derived from this source.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

D.5. OTHER STUDY OR ANALYSIS. Use this paragraph to describe a study or other analytic effort used to derive data for the assessment. Describe the details of this study or analysis from the report for the effort. Repeat this paragraph as necessary for multiple studies and analyses. This paragraph varies in scope and complexity depending on the size and sophistication of the anticipated study or analysis. It provides the basis for understanding the value and context of the data derived from this source.

APPENDIX E. SUPPLEMENTAL ANALYSIS.

a. This appendix is not used for TER (AE) or TR for FDTE, CEP, and CT.

b. The evaluator writes this appendix. Add this appendix only if performing additional analyses. Include evaluator analyses and excursions performed on the data, but not included in chapter 3. Analyses should be grouped by issue and ordered in the same order the issues are addressed in chapter 3.

APPENDIX F. SCENARIO.

a. This appendix is not used for OA/EOA with no user test.

b. The tester writes this appendix. For this appendix, update the same scenario(s) documented in the TEP to reflect the actual events, times, locations, and conditions that occurred during the test.

c. Normally, the pilot test portion of the scenario(s) is not shown in this appendix. However, include any usable data collected during the conduct of the pilot test in the applicable portion of the report.

d. This information is normally covered in paragraph 2.4.1.1 of the body of this report. The tester should add this appendix if the information in the body of this report is insufficient to fully describe the scenario(s) in detail.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

APPENDIX G. SYSTEM DESCRIPTION.

a. This appendix is optional if paragraph 1.4 of the report adequately covers the details.

b. The tester prepares this appendix and includes a description of the system (or combat/training developments product). He should describe the system and its major roles, missions, and components or characteristics. A description of similarities and differences between the system under test and the objective system under development is appropriate here.

c. Summarize the concept for force structure and employment. If a large amount of detail is required to adequately understand the system, include a lengthy system description in this appendix.

d. For OA/EOA with no user test, the evaluator prepares this appendix (only if paragraph 1.4 of the OA/EOA is insufficient to cover the details). For TR of FDTE, CEP, and CT, the tester includes a description of the system/product under test in this appendix (which is optional if paragraph 4 of the TR adequately covers the details).

APPENDIX H. THREAT.

a. Paragraph 2.4.1.3 of the body of the TER normally covers this information. Add this appendix only if the information in the body of the report is insufficient to fully describe the threat portrayed.

b. The evaluator prepares this appendix only for full-evaluate systems. The tester prepares this appendix for TER (AE) and TR of FDTE, CEP, and CT. They define the approved threat in the post-IOC timeframe of the tested system and include capabilities, typical means of operation, and known methods of defeating the system.

APPENDIX I. TRAINING OF PLAYER PERSONNEL.

a. This appendix is not used for an OA/EOA with no user test.

b. The tester prepares this appendix. Describe the training of player personnel.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

c. For user testing, the training of player personnel concentrates on providing the skills necessary to operate the equipment, maintain the equipment, and perform the tactics or operations used in the test. The results of the test will be sensitive to the amount and quality of player training. In fact, for some tests, the amount and type of training received by various individuals or groups of players will be a major test variable.

d. For those tests including a played OPFOR, the units portraying the enemy are trained to employ the tactics of the threat force. The employment of U.S. tactics and procedures by OPFOR may invalidate or cast doubts on results of the test.

e. For all tests, document the actual training received as part of the final report. Describe the actual training received by player personnel, as necessary. Where necessary, include the subjects, lesson plans, training schedules, time required, special training aids or devices used, and (when applicable) special qualifications of the instructors.

f. Document the receipt of the trainer's OTRS prior to the start of test. The trainer's OTRS may be included in this appendix.

g. When the training information is extensive, place it in this appendix. Paragraph 2.6 of the body of the report normally covers this information. Add this appendix if the information in the body of the report is insufficient to fully describe the training conducted.

APPENDIX J. OBSERVATIONS BY TEST TEAM PERSONNEL.

a. This appendix is not used for an OA/EOA with no user test. The tester has the discretion to add this appendix.

b. The information contained in these assessments is based on observations and does not necessarily have to be supported by specific test data. Paragraph 2.9 of the body of the report may cover this information.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

APPENDIX K. COMMENTS FROM UNIT COMMANDERS.

a. This appendix is not used for an OA/EOA with no user test. The tester has the discretion to add this appendix.

b. Include pertinent comments from key unit personnel that have a relationship to the test. The comments do not have to be supported by test data and may be based on personal opinions. Provide appropriate comments by the commanders of the player units to include OPFOR players.

(through)

APPENDIX X. AUTHORS AND SUPPORTING PERSONNEL.

a. The evaluator prepares this appendix only for full-evaluate systems. The tester prepares this appendix for TER (AE) and TR of FDTE, CEP, and CT.

b. For historical purposes, they list all individuals having input to or knowledge of the writing of the report in this appendix. List and designate all members of the STF.

c. If the listing of personnel on the coordination sheet is sufficient, add a placeholder to show that this appendix is "not used."

APPENDIX Y. GLOSSARY, ACRONYMS, AND ABBREVIATIONS.

a. The evaluator prepares this appendix only for full-evaluate systems. The tester prepares this appendix for TER (AE) and TR of FDTE, CEP, and CT. The evaluator and the tester both input to this appendix.

b. This appendix defines any unusual technical terms or frequently used acronyms and abbreviations in the body of the report or in other appendixes The evaluator includes those terms which he has introduced in the report. The tester includes those terms that he has introduced which were not previously defined by the evaluator.

c. If there are no terms needing definition, add a placeholder to show that this appendix is "not used."

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

DETAILED GUIDANCE FOR THE DEVELOPMENT AND DOCUMENTATION OF TEST, EVALUATION, AND ASSESSMENT REPORTING DOCUMENTS (CONTINUED)

APPENDIX Z. DISTRIBUTION.

a. The evaluator prepares this appendix only for full-evaluate systems. The tester prepares this appendix for TER (AE) and TR of FDTE, CEP, and CT.

b. The evaluator or the tester shows distribution of the report by organization and number of copies in this appendix.

Figure 6-11. Detailed guidance for development and documentation of reporting documents (cont)

Chapter 7
Special Considerations in Operational Test and Evaluation

Section I
General

7-1. Joint and multiservice operational test and evaluation

a. Joint and multiservice T&E is acquisition process testing. It is a type of JT&E conducted on a system being acquired by more than one DOD Component. Multiservice T&E planning, conduct, reporting, and evaluation shall include the participation and support of all TIWG members. The lead service will have overall responsibility for management of the MOT&E program and will ensure that Supporting Service requirements are included in formulation of the basic resource and planning documents. The Supporting Service will ensure that all of their requirements are made known, and will assist the lead service in execution of the T&E program. The lead service is responsible for preparing and coordinating a single TEMP, a single test plan, and a single test and evaluation report reflecting the system's technical performance and operational effectiveness and suitability for each service component. Coordination of the TEMP will be as depicted in Part II, this pamphlet. MOT&E are normally initiated by a Joint Service Operational Requirement (JSOR). (See AR 71-9.) Testing procedures for multiservice test and evaluation follow those of the lead service, with variance as required, resolved through mutual agreements.

b. The Memorandum of Agreement (MOA) on MOT&E and JT&E, signed by the operational test agency (OTA) commanders provides a basic framework and guidelines for planning, conducting, evaluating and reporting T&E involving two or more operational T&E agencies. OPTEC is the Army proponent for this MOA. The MOA is reviewed and updated annually and the lead is rotated among the services.

c. Test Planning. Test planning for MOT&E will generally be accomplished in the manner prescribed by lead service directives. The below listed general procedures, however, will be followed:

(1) The lead service OT&E agency will begin the planning process by issuing a call to the Supporting Service OT&E agencies for user requirements, critical operational issues (COI), and test objectives.

(2) The lead service OT&E agency will consolidate these user requirements, COIs and test objectives which will then be approved by all services OT&E agencies involved in the test. Service-unique issues will be included as COIs and/or objectives.

(3) The lead service OT&E agency will accommodate supporting service OT&E requirements and inputs in the formal coordination action of the TEMP. Coordination actions will accommodate service unique staffing approval requirements. The TEMP will be prepared in accordance with Volume I of this pamphlet.

(4) Participating OT&E agency project officers will meet for the purpose of assigning responsibility for accomplishment of test objectives to each OT&E agency. These assignments will be made in a mutually agreeable manner. Each agency will then be responsible for resource identification and accomplishment of its assigned test objectives under the direction of the lead service OT&E agency.

(5) The lead service OT&E agency, with assistance from all participating agencies, will develop a matrix to provide a comparison of the developer's specifications, user's requirements, and service operational criteria. It is not a source document, but it increases management visibility of program requirements, increases communications, and illuminates disconnects.

(6) Each participating agency will then prepare the portion of the overall test plan(s) for its assigned objectives, in the lead service's test plan(s) format, and will identify its data needs.

(7) The lead service's OT&E agency will prepare the MOT&E plans, consolidating the inputs from all supporting agencies. After consolidation, the OT&E plans will be coordinated with the supporting services.

d. Test Reporting. The following test reporting policy will apply for all MOT&E programs.

(1) The lead service will prepare and coordinate the report reflecting the system's operational effectiveness and suitability for each service. It will synthesize the different operational requirements and operational environments of the involved Services. It will state findings, put those findings into perspective, and present rationale why there is or is not consensus on the utility of the system. The report will be signed by all participating services.

(a) Each participating OT&E agency may prepare an independent evaluation report and a final test report, if required, in its own format and will process that report through its normal service channels.

(b) The participating services' independent evaluation reports and/or final test report will be appended to final reports.

(c) Reports, as required, will be submitted through the lead service's normal channels to OSD's Director of Operational Test and Evaluation (DOTE) and OSD's Deputy Under Secretary of Defense for Research and Engineering, Test and Evaluation (DDDRE(T&E)) at least 45 days prior to a milestone decision or the date announced for the final decision to proceed beyond low rate initial production (LRIP). An interim summary OT&E report shall be submitted if the formal end of test phase report is not available 45 days prior to the milestone review. A single integrated multiservice report will be submitted 90 calendar days after the last test event as defined in the MOT&E plan. This may be defined as the final bomb drop, gun fired, final communication sequence completed, etc., and should be agreed to by all service participants.

(2) Interim test reports will normally not be prepared. For test phases which extend for lengthy periods, interim test reports should be submitted at least annually. Test reporting requirements will be defined in the TEMP. When required, interim reports will be prepared in accordance with lead service's directives and coordinated with all participating OT&E agencies prior to release. The separate OT&E agencies may submit interim reports through normal service channels based on service-unique requirements, keeping other participating OTA's informed.

(3) For those reports not requiring submission to DOTE and DDDRE(T&E/LFT)), a single multiservice report is not required, but may be prepared upon concurrence of all participants. Independent evaluation reports, if prepared, will be forwarded to appropriate commands and the other OT&E participants within 90 calendar days after the last test event.

(4) The lead service OT&E agency will be responsible for preparing the appropriate briefing(s) which will be coordinated with all participating OT&E agencies.

e. Deficiency reporting in MOT&E.

(1) The deficiency reporting system of the lead service will normally be used. All members of the multiservice test team

will report deficiencies in that system. All information needed by the participants will be collected. Each deficiency report will be coordinated with all DTDs prior to release. If the Test Director or any Deputy Test Director disagrees with the report, he may attach an explanation of his disagreement to the deficiency report. The report will then be submitted to the appropriate developing agency with that explanation attached. The underlying philosophy is that each participating agency will be allowed to report all deficiencies that it identifies; the lead service will not suppress those reports. Each DTD will be responsible for submitting deficiency reports into his own service's deficiency reporting system if his OT&E agency so requires.

(2) The lead OT&E agency will ensure a system is set up to track reported deficiencies and to provide periodic (monthly is preferred) status reports of those deficiencies to the participating OT&E agencies and to the test team.

(3) Items undergoing test will not necessarily be used by each of the services for identical purposes. As a result, a deficiency considered disqualifying (a deficiency deemed to be of such magnitude that the system will not meet a COI) by one service is not necessarily disqualifying for all of the services. Deficiency reports of a disqualifying nature must include a statement by the concerned service of why the deficiency has been so classified. It should also include statements by the other services as to whether or not the deficiency significantly affects them.

(4) In the event that one of the participating services identifies a deficiency that it considers warrants termination of the test, the circumstances should be reported immediately to the Test Director. All testing will be suspended to afford participating Services an opportunity to discuss the deficiency. If all participants may determine that tests can continue safely on a limited basis pending subsequent correction of the deficiency. If agreement cannot be reached concerning the nature and magnitude of the deficiency, it will be necessary for the Test Director to consider what portions of the test, if any, are unaffected by the deficiency and can be continued safely while the deficiency is being corrected. Immediately upon making such a determination, the Test Director shall provide the OT&E agencies with the circumstances concerning the deficiency, the positions put forth by the DTDs, his decision and reasons therefore.

7-2. OPTECs Operational Test and Evaluation in Support of U.S. Special Operations Command (USSOCOM)

a. The nature of SOCOM's mission, their requirements for peculiar equipment and the expediency in which that equipment is needed raise several issues in test and evaluation support. SOCOM and OPTEC must work together to conduct operational test and evaluation and other user testing and in accordance with the DOD 5000 series directives and AR 73-1 and still meet the requirements of SOCOM.

b. SOCOM's peculiar acquisitions will be supported with OPTEC operational test and evaluation efforts. SOCOM will formally request operational test support on an as needed basis. In turn, OPTEC will prepare test plans, conduct tests within the limits of available resources, and render a test and evaluation report (with up to level 5 data) upon completion. All related test costs will be assumed by SOCOM. U.S.A. John F. Kennedy Special Warfare Center (USAJFKSWC) will serve as combat and training developer representative. Tests requiring U.S. Army support beyond that which can be provided collectively by OPTEC and USSOCOM will be resourced in accordance with the Army's Test Schedule and Review Committee (TSARC) process. Multiservice tests are not included in this agreement and will be conducted according to DODI 5000.2.

c. OPTEC will:

(1) Plan and conduct SOCOM operational and other user tests (CT, CEP, EUTE, LUTE, IOTE, FOTE), report results, and provide evaluations of each tested system's operational effectiveness and suitability.

(2) Exercise quality control over the planning, execution, and reporting of all SOCOM operational test.

(3) Provides operational test and evaluation guidance and assistance to ensure a smooth, responsive, and expedient materiel acquisition process.

(4) Provide USSOCOM a cost estimate at T-730, 365, and 180 days prior to test date.

d. SOCOM will:

(1) Designate USAJFKSWC as USSOCOM's combat developer for all U.S. Army programs.

(2) Provide critical operational issues and criteria (COIC) for all Special Operational Forces (SOF) programs.

(3) Request operational testing support through HQ, OPTEC, ATTN: CSTE-MP.

(4) Prioritize CEP/CT/FDTE/EUTE/LUT/IOTE/FOTE requirements for SOF programs.

(5) Provide funds and resources as required to support test and evaluation.

e. Personnel, equipment, facilities, and other resources required by OPTEC beyond its own for SOCOM operational and other user tests will be identified in the Outline Test Plan (OTP) and formally coordinated through the Test Schedule and Review Committee (TSARC)/Five Year Test Plan (FYTP) process. This includes USSOCOM troops, equipment, and facilities.

Section II
OPTEC Support to U.S. Army Training and Doctrine Command (TRADOC)

7-3. Operational test and evaluation and other user test in support of TRADOC

a. Testing of TRADOC nonmateriel products. TRADOC, as a combat and training developer and user representative, is dependent upon the results of operational T&E conducted by OPTEC in support of materiel acquisition and TRADOC Force Development Evaluation. OPTEC will plan and conduct operational tests of materiel systems, specifically including new and changed hardware and software components and both system training devices and non-system training devices (NSTD).

b. Both TRADOC and OPTEC use operational T&E results to support development of their respective positions for milestone decision reviews (MDR) during acquisition or change (Materiel Change (MC)) of materiel systems.

c. TRADOC develops the doctrinal, training, organizational, and threat aspects of the "total system" and provides these to OPTEC as test support packages. Additionally, TRADOC is dependent on OPTEC to conduct tests and experiments focusing specifically on unique TRADOC products of DTLOM in support of soldiers. The results of these tests and experiments support TRADOC force development evaluation, and resultant decisions, regarding these products.

d. The Test Schedule and Review Committee (TSARC) serves as the mechanism for coordinating, scheduling, resourcing, and

prioritizing the Army's Five Year Test Program (FYTP). The FYTP is the basis for conducting operational T&E and is updated semiannually. OPTEC chairs the working group and DA General Officer (GO) TSARC while TRADOC is a key participant. TRADOC will participate in the TSARC working group meeting to impact outline test plans (OTPs) for and to coordinate priorities of all EUTE, OT, and FDTE (both materiel and nonmateriel). The DA working group TSARC applies prioritization, methodology, and builds the presentation for the HQDA GO TSARC.

e. TRADOC prioritizes CEP requirements and identifies resources needed to conduct those CEP and supporting CEP tests during the annual TRADOC CEPSARC. TRADOC provides OPTEC the approved CEP priority list and distributes CEP funds. OPTEC schedules the CEP test priorities into the total test requirements based on available resources and provide TRADOC a CEP test schedule. CEP tests are second in priority work to FYTP scheduled tests.

f. T&E mission area alignments depicted in figure 7-1 reflect the alignments of TRADOC proponents, Operational Evaluation Command (OEC) directorates, Test and Experimentation Command (TEXCOM) directorates, and OPTEC Test and Evaluation Coordination (TECO) offices, to accomplish the operational T&E mission. Direct communications among aligned activities to facilitate execution of responsibilities and exchange of information/products are authorized.

g. TRADOC will:

(1) Prioritize EUTE, OT&E, and FDTE requirements (those materiel systems for which TRADOC is funding the test and is the combat or training developer and major DTLOM products) for integration into the Army FYTP produced by the DA TSARC. (HQ TRADOC, TSARC)

(2) Conduct pretest training of player personnel in accordance with approved Training Test Support Packages (TTSP) and certify training readiness for test participation.

(3) Conduct test planning working groups for FDTE and, as appropriate, CEPs and CTs. Provide membership to TIWG for OT&E.

(4) Monitor planning and development of materiel developer System Support Packages (SSP) to ensure their suitability and timely availability.

(5) Provide combat developer representation for all RAM scoring conferences and data authentication groups (DAG).

(6) Provide limited subject matter expert (SME) support for testing concept and OTP development as requested by OPTEC.

(7) Provide, when appropriate, approved standard tactical scenarios for use in test design.

(8) Provide membership to Operational Test Readiness Reviews (OTRR) and certify test readiness via Operational Test Readiness Statements (OTRS) for doctrine/organization, threat, and training, as appropriate.

(9) Conduct long range planning to identify Concept Based Requirements System (CBRS) test and evaluation requirements.

(10) Develop the Threat Test Support Package, associated appendixes, and OPFOR training if required. Development and early delivery of this material is critical when force on force testing is being conducted or when OPFOR is employed.

(11) Validate the Threat Test Support Package and the test threat portrayal (CAC Threats).

(12) For tests and experiments not involving an established PEO/PM or other MATDEV (CEP, CT, and nonmateriel oriented FDTE), initiate request for Safety Release to TECOM.

(13) Assist OPTEC as appropriate in development of public affairs support plans for tests scheduled to be conducted on TRADOC installations.

(14) As a minimum for identification of test requirements, TRADOC will provide (for FDTE, CEP, and CT [TEXCOM-test activity]) draft chapter 1 of a TRADOC TEP. It will contain a complete set of OIC; overall test purpose and scope; background and/or history; the system, concept, or force structure description that is to be tested, concept of employment, and any threat to be played/portrayed.

(15) Identify funds and resources for evaluation of TRADOC products.

(16) Monitor testing of nonmateriel products when deemed necessary.

h. OPTEC will:

(1) Execute all Army EUTE, OT&E, and FDTE prioritized by the TSARC. Within available OPTEC capacity and subject to

availability of appropriate funds, conduct CEP tests and CT as coordinated with TRADOC.

(2) Chair the Army TSARC to prioritize the FYTP.

(3) Host meetings with TRADOC commanders/commandants and other TRADOC representatives to review test support provided by OPTEC.

(4) Chair and provide operational tester and/or evaluator representation at RAM scoring conference as required.

(5) Provide all needed assistance to TRADOC proponent commanders/commandants in nominating tests, to include input for CEP resume sheets being prepared by the proponent for TRADOC CEPSARC submission.

(6) In accordance with AR 385-16, obtain a Safety Release from Army Materiel Command, Test and Evaluation Command (TECOM), ATTN: AMSTE-ST, for each operational test it conducts. Safety Release must be available to test directorate and TRADOC proponent prior to all tests and pretest training of troops.

(7) Manage the user test instrumentation program.

(8) For tests/experiments scheduled to be conducted on TRADOC installations, coordinate public affairs aspects with the public affairs officer of the host TRADOC installation.

i. Resources and support

(1) General. TRADOC supports OPTEC activities located on TRADOC installations with general housekeeping services (public affairs, finance, medical, civilian personnel, military personnel, military justice, base operations, contracting, MCA, etc.). The details of this day-to-day support will be captured in appropriate agreements between OPTEC and each installation.

(2) T&E Specific. In some cases it may be necessary to pool resources to execute the Army's operational T&E program. Specific areas are discussed below.

(a) Personnel, Equipment, Facility, and Other Resources.

(b) Support required by OPTEC to execute the Army's operational T&E program will be identified in OTPs and published in the FYTP. OPTEC will prepare the OTP and formally coordinate with TRADOC. Informal coordination with the installation tasked to provide the support is encouraged.

(c) For T&E of TRADOC products not in the FYTP, the TRADOC proponent will prepare the cost estimate for the RS. In addition, proponent will coordinate all resources required to conduct the test with the appropriate MACOM before staffing RS.

(3) Funds.

(a) OPTEC plans, manages, and executes all funding to support EUTE and OT&E. OPTEC funds TRADOC participation in EUTE and OT&E identified in OTPs (e.g., CBTDEV and TNGDEV TDY, maintenance of equipment, and test player training).

(b) TRADOC plans, manages, and distributes to OPTEC for execution all funds to conduct FDTE, CEP, and TRADOC initiated CT. TRADOC prioritizes CEP (CEPSARC) and distributes CEP funds in accordance with the CEP resume sheet (e.g., OPTEC, TRADOC, and FORSCOM test support), procurement/lease maintenance of test item (when applicable), and TRADOC evaluation effort.

(4) Post deployment software support. TRADOC and OPTEC will continue to participate, with the MATDEV, in collocated Post Deployment software support (PDSS) activities at Fort Sill and agree to pursue similar arrangements there and elsewhere as long as appropriate.

7-4. OT&E strategy for Information Mission Area (IMA) and software intensive systems (systems developed under AR 70-1 with extensive embedded software and computer resources). A new, flexible strategy has been developed to expedite fielding of software-intensive systems. It is consistent with the DOD 5000 and DOD 7920 series guidance, including the requirement to identify LRIP items earlier at MS II. The strategy also implements the Software T&E Panel (STEP) recommendations for a unified software process. This strategy applies to both materiel systems with extensive embedded software, and IMA systems. Traditional weapon system OT&E requires the entire system to successfully complete OT&E of production-representative items before fielding (MS III). The new strategy allows fielding of parts of software intensive systems, once successful OT&E of a representative sample has been accomplished.

a. The keystone of the new strategy is the MS IIIn approach shown in the illustration. (See figure 7-2.) The time line in the illustration begins after MS II. If a system has a hardware and Commercial-Off-The-Shelf (COTS) software component (operating system, communications software, data base management system, query language), the operational tester conducts a limited user test (LUT) to determine successful interoperability of the

hardware and COTS software and its interaction with users (soldiers or civilians) and the operational environment.

b. A test bed must be configured and fielded to support the LUT. Authorization to purchase and field the LUT test bed occurs at Milestone II or, in cases where the design is incomplete, on approval (by HQDA or DoD, depending on the level of oversight) of the test and evaluation plan.

c. Following a successful test, the operational tester will redefine the test-bed for the IOTE of block 1 of the developed software to appropriate sites beyond those required for the LUT. The operational test bed may increase in size to support testing of subsequent (1 through n) blocks of developed software.

d. Representative sample.

(1) Each block of developed software must provide added functionality or necessary integration capability with other systems and must stand alone, in the event that subsequent blocks are never fielded. The operational tester will conduct an IOT for each block. When a representative sample of the total software functionality to be developed has successfully completed IOTE, the operational evaluator will provide a fielding recommendation to the MS III.C (fielding certification) decision review body.

(2) To reach a representative sample, some number of blocks must sufficiently stress the hardware, COTS software, intra-system connectivity, and communications network. Definition of a representative sample will differ for each system. Generally, the representative sample will be determined by collating the critical mission functions from the requirements documents with the hardware and COTS software capabilities.

e. Fielding - MS III.C

(1) DOD or HQDA approval at MS III.C will allow the Army to authorize, purchase and fielding, to all users of 100 percent of the hardware and COTS software and all developmental software successfully tested to date.

(2) The OT&E activity will conduct additional IOTEs for software blocks developed after MS III.C. Each block may be fielded after successful IOTE. For each IOTE and LUT, the operational evaluator will prepare an operational assessment. When the final block has completed IOTE, the operational tester and evaluator will provide a Test and Evaluation Report to

address the total system's operational effectiveness and suitability.

(3) The jagged vertical line in the illustration can move to the left or right, depending on the definition of a representative sample of the blocks of software to be developed. Many systems will have no more than one or two blocks; some may have several; regardless of the design, the OT&E strategy can be tailored to support the development and fielding strategy.

f. Critical mission functions (CMFs), IOTE readiness criteria, and tripwires.

(1) Other features of the new strategy include: the addition of CMFs to Part I of the TEMP; criteria for determining readiness for IOTE; and tripwires to determine IOTE requirements when changes are made to the CMFs, hardware, COTS software, or the communications network.

(2) CMFs describe the minimum acceptable functionality that must be provided before each block of the system can be fielded. CMFs are developed and prioritized by the user representative and are based on the user's requirements. CMFs are grouped into and enabled by blocks of developed software. An example of a CMF for a weapon system might be to provide position location; an example for an IMA system might be to process officer promotions.

(3) As part of the strategy for successful fielding of software-intensive systems, IOTE will not start without some assurance that the system can successfully function in the operational environment. In addition to the standard OT readiness statements from the PM, user representative, developmental and operational tester and evaluator, the OT&E activity will require the Configuration Control Board (CCB) to certify that each block is ready for test.

(4) Testing of changes to blocks and systems after fielding must be considered. If one of the following three tripwires is activated, the CCB is required to notify the OT&E activity:

(a) Significant impact on or change to CMFs.

(b) A computer resource change that affects system operation or supportability.

(c) Changes to more than 15 percent of the software.

After examining the changes to be made, the OT&E activity will determine whether new OT&E is required. Otherwise, normal post-deployment software support (PDSS) testing will occur.

7-5. Foundations and history
History of operational test and experimentation and operational evaluation. (See figure 7-3, Key T&E Events.)

T&E MISSION AREA ALIGNMENTS

TRADOC PROPONENT	OEC EVAL DIR	TEXCOM TEST DIR	OPTEC TECO
Air Defense	Counterair	Air Defense	
Armor	Close Combat	Armor	X
Aviation	Aviation	Aviation	X 1
Aviation Logistics	Aviation	Aviation	
Chemical	Cbt Spt	Cbt Spt	
Engineer	Cbt Spt	Cbt Spt	X
Field Artillery	Fire Support	Fire Support	
Infantry	Close Combat	Infantry ABSOTD 2	X
Intelligence	Intelligence	Intel Elec Warfr	
Military Police	Cbt Spt	Cbt Spt	
Ordnance	Cbt Spt	Cbt Spt	
Ordnance Missile & Munitions	Cbt Spt	Cbt Spt	
Quartermaster	Cbt Spt	Cbt Spt ABSOTD 2	
Signal	C4	C3	X
Transportation	Cbt Spt	Cbt Spt	
SSC & associated schools	Cbt spt	Cbt Spt	
SWCS	Cbt Spt	ABSOTD 2	
CACDA	C4	C3	
CASCOM 3	Cbt spt	Cbt Spt	X 4

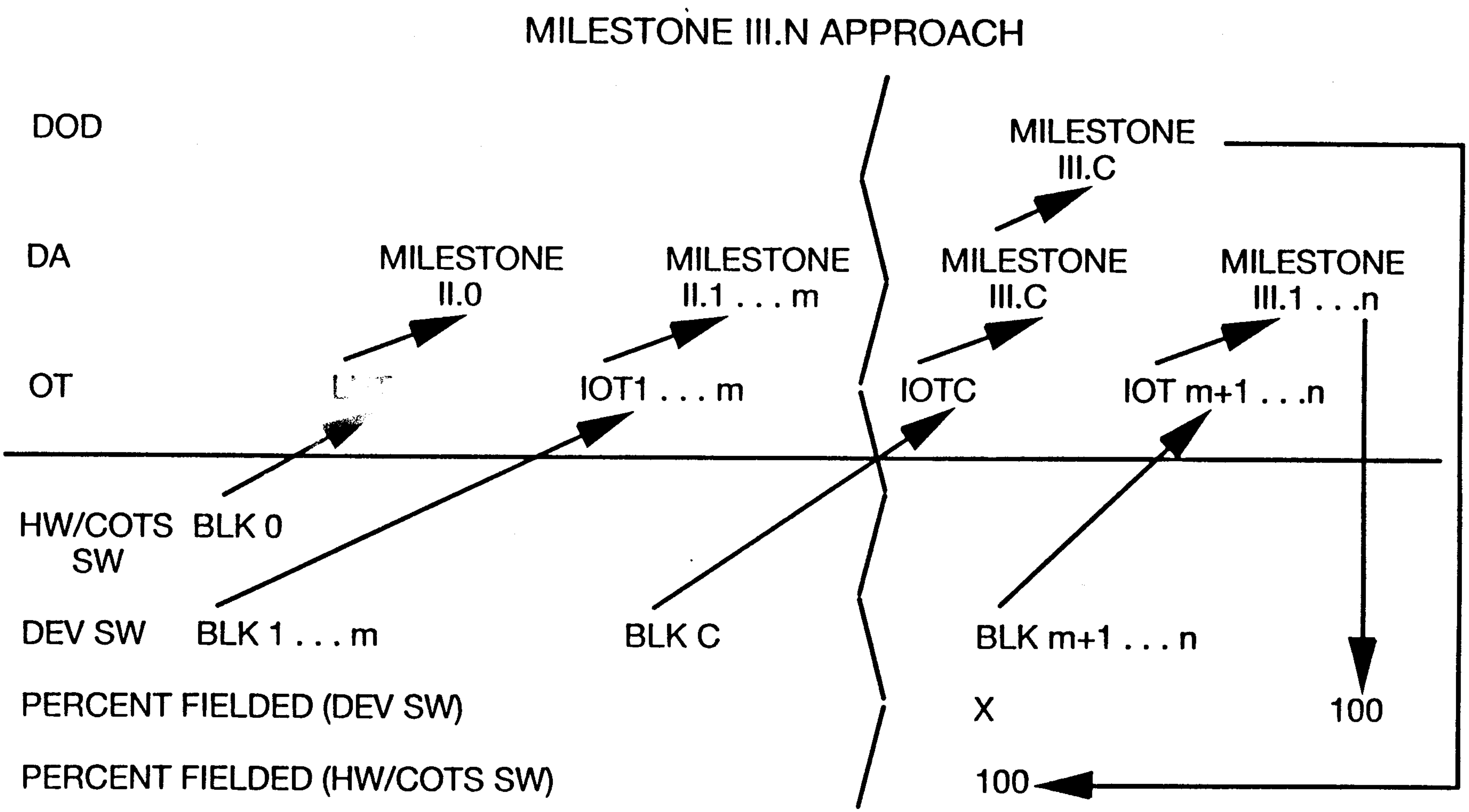
Note 1 - Supports Aviation Logistics School as required.

Note 2 - For special operations and airborne missions (Infantry and Quartermaster), ABSOTD will be the aligned test directorate.

Note 3 - CASCOM commander will consoldiate input pertaining to selection/evalaution of Combat Support Director at TEXCOM and selection of Combat Support Director at OEC.

Note 4 - Also supports Aviation Logistics School, Chemical School, Military Police School, Ordnance Center and School, Ordnance Missile and Munitions Center and School, Quartermaster School, Transportation School, and Soldier Support Center and associated schools as required.

Figure 7-1. T&E mission area alignments



MILESTONE III.C - CERTIFICATION FOR HW/COTS SW FIELDING
MILESTONE III.n - IER FOR TOTAL SYSTEM EFFECTIVENESS/SUITABILITY

Figure 7-2.OT&E strategy for software-intensive systems.

Foundations and History of User Test and Experimentation and Operational Evaluation

a. The objective of OT&E is to support the materiel acquisition process (MAP) by providing independent evaluations of operational effectiveness and suitability based on all available information. OT&E relies on realistic testing of a system when operated and maintained by typical users, in the same environment and organization in which it is to be deployed. OT&E directly contributes to decisions on whether to proceed with developing, procuring, modifying, or deploying a system. Because OT&E is an integral part of the materiel development and decision making process, it must be responsive to program objectives, milestones (MS), and acquisition strategies (AS). The structured approach described in this pamphlet applies to all OT&E.

b. Current OT&E practices have evolved over many years. The goal of these continuing efforts has been to provide improved comprehensive system evaluations in support of the MAP. In May 1970, the Department of Defense (DOD) recognized the need for an independent estimate of the operational effectiveness and suitability of materiel systems. DOD recommended that each DOD component establish an agency responsible for OT&E separate from the developing, procuring, and using commands. After the 1970 Blue Ribbon Defense Panel report to the President and the Secretary of Defense (SECDEF) the Army established the Operational Test and Evaluation Agency (OTEA). The following 10 major documents and events have shaped the OTEA mission.

(1) Blue Ribbon Defense Panel. In July 1969, a Blue Ribbon Defense Panel was appointed by the President and SECDEF to study the organization, structure, and operation of DOD. As a result of panel recommendations, OTEA was established in 1972 and assigned responsibility for operational testing (OT) and providing independent evaluations of systems based on those tests. The panel found that OT&E should:

(a) Consider the interface with other systems and equipment, tactics and techniques, organizational arrangements, and the human skills and capabilities of the eventual users.

(b) Contribute more to materiel acquisition decisions, be conducted in a realistic operational environment with typical user troops, and be independent of the developing, procuring and using commands.

Figure 7-3. Key T&E events

(2) Department of Defense Directive (DODD) 5000.3 replaced by Department of Defense Instruction (DODI) 5000.2. Each revision of DODD 5000.3 increased emphasis on thorough system OT&E to support decision makers. DODD 5000.3 (1973) directed each DOD component to establish a major, separate field agency to conduct OT&E. It directed each service's operational test activity (OTA) to report the operational effectiveness and suitability of developing systems directly to its military service chief. The 1978 revision emphasized establishing critical issues, test criteria, and measures of effectiveness (MOEs) early in the acquisition cycle. Operational Test Activities (OTAs) objectives were expanded to include survivability, vulnerability, transportability, safety, human factors, compatibility, interoperability, reliability, availability, maintainability, logistics supportability, and training requirements. OT&E agencies were charged to participate in the initial planning for developmental testing and evaluation (DT&E), including participating in the early stages of software planning and development. The 1979 directive emphasized planning documentation for test and evaluation (T&E) and provided guidelines for preparing the Test and Evaluation Master Plan (TEMP). The 1986 directive emphasizes the use of analysis, modeling, and simulation to complement developmental testing (DT) and OT. It also directed the developer and the agencies to establish databases for sharing information and data during the acquisition process. It mandates the defining of critical T&E issues, objectives, methodologies, and evaluation criteria while the acquisition program is being established.

(3) Army Materiel Acquisition Review Committee (AMARC) Report. AMARC was formed in December 1973 to review and analyze the MAP. As a result, AMARC recommended that the Department of the Army (DA):

(a) Emphasize the technical orientation of DT and the operational orientation of OT.

(b) Stress independent test design and evaluation rather than separate DT and OT as a solution to the problem.

(c) Have OTEA report directly to the Chief of Staff, Army (CSA).

(d) Expand the OTEA mission to include oversight of significant nonmajor systems.

(4) Letter of the Vice Chief of Staff, Army (VCSA). This August 1983 letter directed OTEA to track the correction of deficiencies for major systems and certain acquisition programs throughout the MAP and to summarize periodically the

Figure 7-3. Key T&E events (cont)

(5) Government Accounting Office (GAO) Report. The GAO Report, "The Army Needs More Comprehensive Evaluations To Make Effective Use of Its Weapon Systems Testing," February 1984, recommended that one principal evaluation agency be named the Army's overall evaluator. This agency would integrate both DT&E and OT&E results to provide a balanced, coherent view of a system's development and operational readiness. Based on the GAO report and a 2 November 1983 meeting between VCSA and the Deputy Chiefs of Staff for Research, Development, and Acquisition (DCSRDA) and Operations and Plans (DCSOPS), the CSA designated OTEA as the Army's comprehensive evaluator in March 1984 and tasked OTEA to begin Continuous Comprehensive Evaluation (C2E) on five pilot programs with assistance from the Training and Doctrine Command (TRADOC) and the Army Materiel Command (AMC).

(6) Test and Evaluation Functional Area Analysis. On 13 May 1985, VCSA chaired the T&E Functional Area Assessment (FAA), ended the pilot C2E program, and directed that C2E be started on other systems as appropriate.

(7) AR 71-3, User Testing, 1 March 1986 and draft DA Pamphlet 71- 3, chapter 12 published December 1988.

(8) Army Test and Evaluation Implementation Plan Review. The Under Secretary of the Army (USA) and VCSA, review of 24 March 1988, designated the Test and Experimentation Command (TEXCOM) as responsible for operational testing of all categories of systems. OTEA (now OPTEC) would selectively test designated systems and be responsible for the operational evaluation of all Army systems unless the operational test results were sufficient to support the full-rate production decision. Test reports on systems for which OTEA was not the evaluator would be expanded to include evaluation information; those expanded reports would contain an abbreviated evaluation by OTEA.

(9) Defense Management Review Decision Number 936 dated 20 November 1989 directed the Army to consolidate the US Army Operational Test and Evaluation Agency (OTEA) in Alexandria, Virginia with the TRADOC TEXCOM located at Fort Hood, Texas into the U.S. Army Operational Test and Evaluation Command (OPTEC). The mission of the new command was to:

(a) Support the Army acquisition process by managing the Army's continuous evaluation and user test programs.

(b) Manage and execute the Army user test process by planning, conducting and reporting on T&E programs.

Figure 7-3. Key T&E events (cont)

(c) Execute user tests to support doctrine, training and force design of the Concept Based Requirements System (CBRS), (See TRADOC Regulation 11-15), in accordance with TRADOC requirements and TSARC established priorities.

(10) DOD Directive 5000.1, Defense Acquisition, 23 February 1991, DOD Instruction 5000.2, Defense Acquisition Management Policies and Procedures, 23 February 1991, and DOD Manual 5000.2M, Defense Acquisition Management Documentation and Reports, 23 February 1991. The three DOD documents are directive in nature and apply to the Military Departments (DOD Components) for the management of major and nonmajor defense acquisition programs. The Army further delineates specific Army test and evaluation policy in AR 73-1, Test and Evaluation Policy dated December 1991.

Figure 7-3. Key T&E events (cont)

DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART SIX

LIVE FIRE TEST AND EVALUATION GUIDELINES

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Chapter 1
Overview

Section I
Introduction

1-1. General
Through a series of amendments to Title 10, United States Code, Congress has mandated that major weapon system and munition programs undergo a realistic Live Fire Test and Evaluation (LFT&E) program. This volume attempts to achieve the following:

a. Present the basis for determining whether a LFT&E program is required for a given system.

b. Describe the key steps in developing an adequate and acceptable LFT&E strategy including the role of modeling and testing in the LFT&E process.

c. Provide guidance on the planning, execution, reporting, and review and approval processes for LFT&E programs.

d. Outline the roles of key LFT&E activities.

1-2. Basic Elements
Figure 1-1 illustrates the basic elements of the overall LFT&E process from initial strategy definition to the writing of the final test and evaluation report(s). While the details of each element of this overall process must be decided on a case-by-case basis, this volume will attempt to provide the foundation required to develop a credible LFT&E program. It draws upon those general approaches and lessons learned from initial LFTs which have proven successful and which should prove beneficial to those individuals involved in future LFT&E programs.

Section II
Why LFT&E?

1-3. General
As stated previously, LFT&E is necessary because it is the law; but, more importantly, it is necessary because it is cost effective and smart testing (i.e., it simply makes sense). A realistic LFT&E program represents the best alternative to "actual" combat in assessing our systems performance and is more cost effective than combat. However, with the lack of actual combat data must come a

disciplined and realistic approach to the assessment of the vulnerability and lethality of our weapon systems. The LFT&E program provides the needed means for assessing the synergistic effects of system component integration and of selected damage mechanisms. A well-planned and well-structured LFT&E program reduces the potential for "surprises" prior to that system's arrival on the battlefield.

(Insert Figure 1-1)

1-4. LFT&E An Essential Element

Furthermore, an active, well-planned, well-managed, and well-executed LFT&E program is essential to understanding system vulnerability/lethality and will be an essential element of the information supporting decisions regarding the acquisition of materiel as well as the development of doctrine and plans for its proper operational employment. When properly structured and scheduled, the LFT&E program will enable design changes resulting from that testing and analysis to be incorporated into the system at the earliest possible date and reduce the need for expensive retrofit programs.

Section III
Objective of LFT&E

1-5. Objective

The objective of LFT&E is to support a timely and thorough assessment of the vulnerability/lethality of a system as it progresses through its development and subsequent production phases. The LFT&E program should demonstrate the ability of the weapon system or munition to provide battle resilient survivability or lethality and provide insights into the principal damage mechanisms and failure modes occurring as a result of the munition/target interaction and into techniques for reducing personnel casualties or enhancing system survivability/lethality. These insights will mature during the course of the LFT&E program. Data will emerge which will identify specific failure and damage mechanisms. With this knowledge, cost effectiveness trade-offs can be conducted to predict the optimal "mix" of vulnerability reduction/lethality enhancement measures.

1-6. Primary Emphasis

The primary emphasis of LFT&E is on realistic testing as a source of personnel casualty, vulnerability, and lethality information to ensure potential design flaws are identified and corrected prior to full-rate production. The LFT&E program should provide an assessment of a system's vulnerability/lethality performance

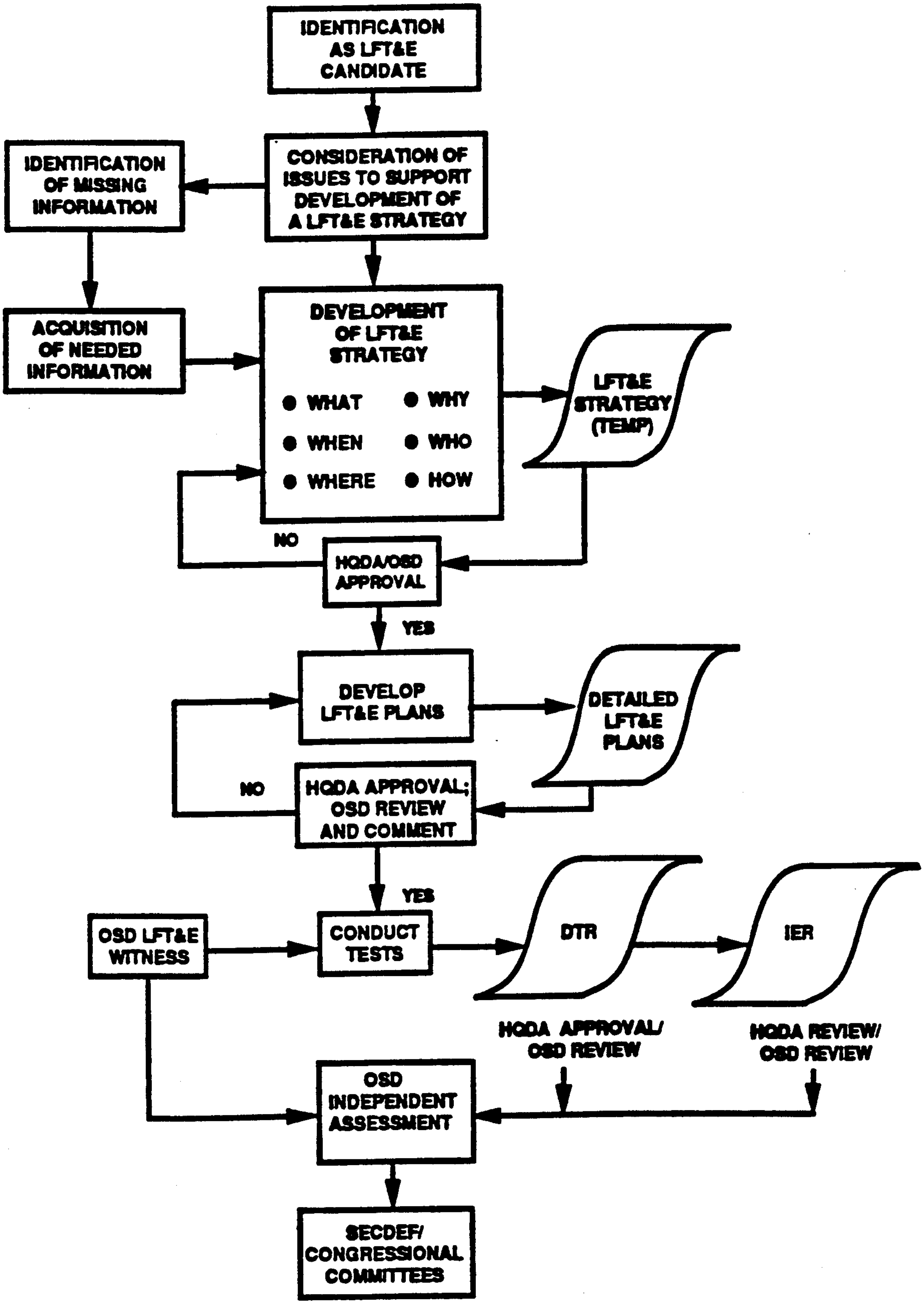


Figure 1-1. Overview of the LFT&E Process

relative to the expected spectrum of battlefield threats; it is not constrained to addressing specific design performance goals or threats. (However, LFT&E, by itself, is not a basis for the decision to transition to full-rate production; many other factors must be considered in arriving at this decision.) Additionally, LFT&E will provide insights into how to enhance the survivability and/or lethality of similar or future systems and provide a mechanism for gaining insights into the adequacy of vulnerability/lethality assessment techniques and supporting data bases.

Section IV
Background

1-7. Genesis

The genesis of LFT began in the early 1980s and was the outgrowth of perceived needs by two separate groups. First, the vulnerability/lethality assessment community was concerned that the technological viability of their assessment techniques was becoming increasingly tenuous because they were relying more and more on questionable extrapolation of existing data bases (rapid advances in technology over the past two decades had simply made many of these data bases outdated and inapplicable). Due to the increasing complexity of foreign and domestic weapon systems and of the munition/target interaction, assessment techniques demand a strong tie to empirical data bases including those based on firings against full-up targets. Staff personnel within Congress, Office of the Secretary of Defense (OSD), and Headquarters, Department of the Army (HQDA) were concerned that testing programs were ignoring the realities of war and were not providing a realistic and rigorous assessment of the likely performance of these systems in combat. They felt that program decisions were too dependent on modeling and component testing and that full-up LFT was needed to judge how well these systems--and the crew who operated them--would survive on the modern battlefield.

1-8. Joint Live Fire Program

The need for full-up testing led to the establishment of the Joint Live Fire (JLF) Program in March 1984; the JLF Program was and continues to be sponsored by OSD as a joint test initiative. The JLF Program is chartered to assess the vulnerabilities and lethalities of fielded conventional U.S. ground systems and aircraft. Army systems initially included in the JLF Program were the Bradley Fighting Vehicle System, the Abrams Tank, and the M113 Family of Vehicles. Because of difference in the philosophic approach to LFT between the Army and OSD (the building-block approach versus large scale full-up testing) and the Army's desire

to accelerate the testing of these systems, the Army subsequently requested and received permission from OSD to withdraw the Bradley, Abrams, and M113 systems from the JLF Program. The Army agreed to fund the cost of the LFT programs for these systems and to provide open access by OSD to test planning, test conduct, and test results. This series of LFTs was known as Army LFT and was completed in 1988.

1-9. Controversy
Controversy over the basic approach to LFT and the Army's conduct of the Bradley Live Fire Test (the perception of test biasing) highlighted the need for LFT and led Congress to mandate such testing for major weapon system and munition programs through a series of amendments to Title 10, United States Code in the FY86 through FY91 Department of Defense (DoD) Authorization Acts. Table 1-1 presents a comparison of the primary features and differences among the JLF, the Army Live Fire, and the Congressionally legislated LFT&E programs. The remainder of this part is devoted to a discussion of the requirements and strategies applicable to Congressionally legislated LFT&E programs.

(INSERT TABLE 1-1)

Section V
LFT&E Legislation

1-10. Title 10
The FY86 and FY87 DoD Authorization Acts amended Chapter 139 of Title 10, United States Code, to require LFT&E prior to proceeding beyond low-rate initial production (LRIP). Specifically, the FY86 legislation requires side-by-side vulnerability LFT&E if a wheeled or tracked armored vehicle is to replace an existing vehicle; the FY87 legislation requires LFT&E for all covered systems and major munition and missile programs. The FY88-89 DoD Authorization Act amended Title 10 to include a LFT&E requirement for product improvements to major systems
(i.e., materiel changes (MC)); the FY90-91 Act requires DoD to report results of LFT before a system enters full-rate production and also acknowledges that procurement funds can be used to support LFT&E programs (such funding shall not exceed one-third of one percent of the total program cost).

1-11. Current Legistlation
To summarize, the current legislation requires that the Secretary of Defense provide that:

a. A covered system not proceed beyond LRIP until realistic survivability testing is completed.

Table 1-1. Comparison of Joint Live Fire, Army Live Fire, and Congressionally Legislated LFT&E Programs

Joint Live Fire	Army Live Fire	Congressionally Legistlated Live Fire
Chartered FY84	Legistlated/Chartered	Legistlated FY86-FY89
Multiservice	Army Only	Individual/Multiservice
OSD Funded	Army Funded	Service Funded
Fielded Systems	Bradley, Abrams, M113 Family	Developmental Systems /PIPs
Vulnerability/ Lethality	Vulnerability	Vulnerability/ Lethality
Armor/Anti-Armor Aircraft	Armor	Air, Land, Sea Systems
Test Event Oriented	Test Event Oriented	Milestone Oriented
OSD Oversight	OSD Oversight	OSD Oversight

b. A major munition or missile program not proceed beyond LRIP until realistic lethality testing is completed.

c. A covered PIP not proceed beyond LRIP until realistic survivability/lethality testing is completed.
The legislation states that the costs of all survivability/lethality testing shall be paid from funds available for the system being tested. The legislation also provides that the Secretary of Defense may waive the requirement for survivability/lethality testing in the time of war or if the Secretary certifies to Congress, before the system enters engineering and manufacturing development (EMD) (formerly full-scale development (FSD)) that LFT of that system would be unreasonably expensive or impractical.

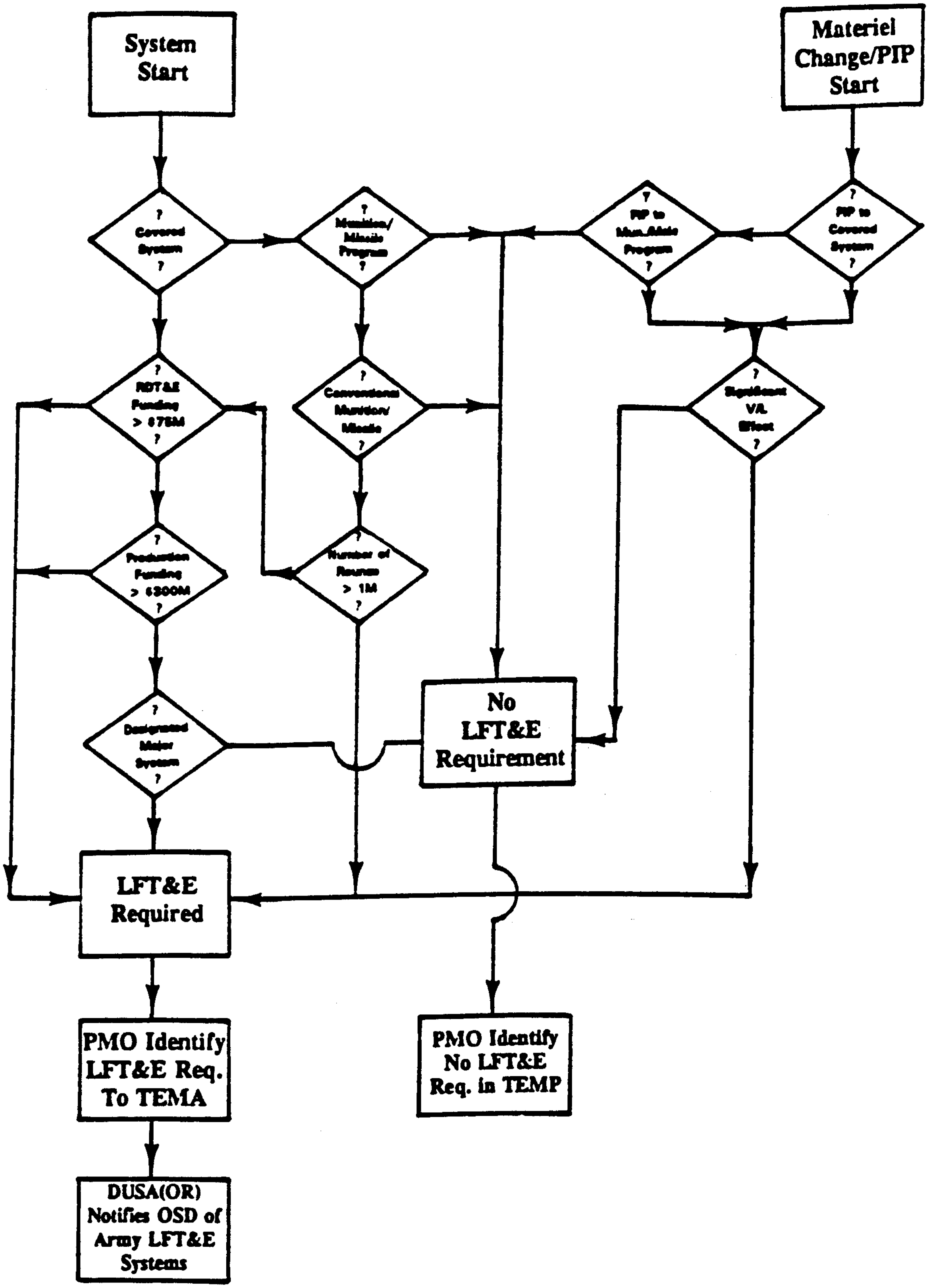
NOTE: Per Department of Defense Instruction (DoDI) 5000.2, 23 February 1991, all acquisition programs, excluding highly classified programs, shall be placed into one of four categories, Acquisition Category (ACAT) I, ACAT II, ACAT III, or ACAT IV. ACAT I and ACAT II programs are major defense acquisition programs and major programs, respectively, and, if they are covered systems or a munition/missile system, will have a LFT&E requirement. ACAT III and ACAT IV munition/missile programs may have a LFT&E requirement if they the meet the 1,000,000 round production requirement.

1-12. LFT&E Requirements
Figure 1-2 provides a flow chart to assist in determining a systems LFT&E requirement. This flow chart addresses both new systems and materiel changes (PIPs) to existing systems. Specific situations (e.g., the LFT&E requirements for "add-ons" to existing systems which have undergone LFT&E) must be addressed on a case-by-case basis. Basically, if a system meets the LFT&E dollar or quantity criteria or if a PIP provides a significant V/L effect, the system has a LFT&E requirement. The degree of LFT&E needs to be addressed in a comprehensive LFT&E strategy, incorporated into the appropriate documentation, and provided the Army leadership for guidance and approval. Per DoDI 5000.2, a systems proposed acquisition strategy developed during Acquisition Phase 0 (Concept Exploration and Definition) "must include provisions for conducting live fire testing on covered systems, major munition programs and missile programs (and covered product improvements programs thereto)"; Army policy requires a system's LFT&E requirement be identified to TEMA and the initial strategy and resource requirements be included in the Milestone I Test and Evaluation Master Plan (TEMP).

(Insert Figure 1-2)

Section VI
Definitions

1-13. Definitions.



NOTE: Dollar quantities are FY80 constant dollars.

Figure 1-2. LFT&E Requirement Flow Chart.

The following definitions of commonly used terms are presented here in order to provide a better understanding of the LFT&E process:

a. Survivability. The capability of a system to avoid or withstand a man-made hostile environment without suffering an abortive impairment of its ability to accomplish its designated mission.

b. Vulnerability. The characteristics of a system that cause it to suffer a definite degradation (loss or reduction of capability to perform its designated mission(s)) as a result of having been subjected to a certain level of effects in a man-made hostile environment.

c. Lethality. The ability of a munition to cause damage that will cause the loss of or a degradation in the ability of a target system to complete its designated mission(s).

d. Covered System. Any vehicle, weapon platform, or conventional weapon system that includes features designed to provide some degree of protection to users in combat and is a major system (see paragraph 5.1.6.g below for the definition of major system).

e. Major Munitions Program. A conventional munitions program that is a major system within the definition given in paragraph 1-13.g or for which more than 1,000,000 rounds are planned to be acquired.

f. Covered Product Improvement Program (PIP). A covered system and/or major munition or missile program for which a planned modification or upgrade is likely to produce a significant effect on the vulnerability and/or lethality of that system/munition or missile.

g. Major System. As specified in Title 10, United States Code, Section 2302(5), a major system means a combination of elements that will function together to produce the capabilities required to fulfill a mission need. The elements may include hardware, equipment, software or any combination thereof, but excludes construction or other improvements to real property. A system shall be considered a major system if:

(1) The DoD is responsible for the system and the total expenditures for research, development, test and evaluation for the system are estimated to be more than 75 million dollars (based on fiscal year 1980 constant dollars), or the eventual total expenditure for procurement of more than 300 million dollars (based on fiscal year 1980 constant dollars).

(2) A civilian agency is responsible for the system and the total expenditures for the system are estimated to exceed 750,000 dollars (based on fiscal year 1980 constant dollars) or the dollar threshold for a "major system" established by the agency pursuant to Office of Management and Budget (OMB) Circular A-109, entitled "Major Systems Acquisitions," whichever is greater.

(3) The system is designated a "major system" by the Secretary of the Army.

NOTE: Per DoDI 5000.2, fiscal year 1990 constant dollars are 115 million dollars for research, development, test and evaluation, and 540 million dollars for procurement.

h. Realistic Testing. For vulnerability testing: the firing of munitions, likely to be encountered in combat, at the weapon system configured for combat. For lethality testing: the firing of the munition or missile concerned at appropriate targets configured for combat.

i. Live Fire Test. A test event within an overall LFT&E strategy which involves the firing of actual munitions at target components, target sub-systems, target sub-assemblies, and/or sub-scale or full-scale targets to examine personnel casualty, vulnerability, and/or lethality issues.

j. Full-up Testing. Firings against full-scale targets containing all of the dangerous materials (e.g., ammunition, fuel, hydraulic fluids, etc.), system parts (e.g., electrical lines with operating voltages and currents applied, hydraulic lines containing appropriate fluids at operating pressures, etc.), and stowage items normally found on that target when operating in combat. Full-up testing includes firings against full-up components, full-up sub-systems, full-up sub-assemblies, or full-up systems. The term "full-up testing" is synonymous with "realistic survivability testing" or "realistic lethality testing" as defined in the legislation covering LFT.

k. Model/Modeling. A vulnerability/lethality assessment tool used to predict one or more aspects of a given munition/target interaction. A model may be anything from a sophisticated computer code (employing many individual algorithms to assess total system vulnerability/lethality) to a simple mathematical expression or empirical relationship used to predict a single element of a munition/target interaction (e.g., the penetration performance of a given munition).

l. Pre-Shot Prediction. An á priori prediction of the expected outcome(s) of a live fire shot. The prediction might, in

special circumstances, be a quantified value of the probability of kill given a hit and/or the expected number of casualties. Most often, the pre-shot prediction will be in the form of quantitative or qualitative expectations of the ability of the attacking munition to defeat the armor or other protective design features of the target and inflict damage to components or personnel; or conversely, the ability of the target to defeat or mitigate the effects of the attacking munition. These predictions can be either absolute expectations of performance or comparative expectations of the relative performance of two or more munitions or targets. The pre-shot predictions may be based on computer models, engineering principles, or engineering judgments.

m. Test Issues. Questions which must be answered in operational and technical testing. Test issues are not necessarily stated in the same form as the system evaluation issues or system test and evaluation critical issues from which they are derived, but test issues must be stated in a manner that ensures those evaluation issues amenable to test can be answered. The emphasis of test issues is on producing data in support of the operational and technical evaluations. Test issues have criteria when needed. Test issues and their criteria are identified by the independent evaluators and published in Independent Evaluation Plans (IEPs) and Test Design Plans (TDPs).

n. Conventional Weapon. Those weapons which are neither nuclear, chemical, or biological.

Section VII
Keys to Success

1-14. Keys to Success

The LFT&E program has and will continue to be one of the most complex and high-visibility phases of weapon system development. It requires proper planning, resourcing, testing, evaluation, and coordination to ensure that critical vulnerability/ lethality issues are effectively and adequately addressed and that the Congressional mandate is satisfied. Based on the experience gained during previous Army LFT Programs (Bradley and Abrams), a number of "keys to success" have been identified which should be useful for future LFT&E programs. These "keys" include:

a. Integration into the Test and Evaluation (T&E) Process. The requirements of LFT&E are comparable to those of any T&E program: one must identify the critical issues, develop a test strategy, coordinate and obtain approval of that strategy, and execute and report the results of that program. Thus, the existing

T&E process not only provides an existing infrastructure and reporting system which can effectively and efficiently accommodate the requirements of LFT&E, but it also avoids the unnecessary step of establishing a separate and unique process simply for LFT&E. As will be discussed in latter sections of this guide, the TEMP is ideally suited for articulating the LFT&E strategy and the Test Integration Working Group (TIWG) is an ideal forum for the planning, coordination, and integration of the LFT&E program.

b. Early Planning. The resource demands, plus the review and approval process, for LFT&E make early planning absolutely essential. Early identification of the critical vulnerability and/or lethality issues, the LFT&E strategy, the test resource requirements, test limitations, and inclusion in the TEMP are necessary to provide:

(1) The HQDA/OSD an understanding of the basic strategy and the adequacy of planned testing and resources.

(2) The Project Manager (PM) an understanding of the system hardware and threat/threat surrogate requirements, many of which require long lead times to procure/develop.

c. Building-Block Approach. The key to understanding a given munition/target interaction is an understanding of the underlying phenomenology. These insights can often be gained and many critical issues addressed through component and/or sub-system testing. Thus, the most cost effective and efficient approach to LFT is a building-block approach. Using such an approach, a development program would progress from early component testing to sub-system/system testing and culminate in a limited series of full-up firings to address personnel casualty, damage mechanism, and critical system vulnerability/lethality issues which can only be answered through full-up testing. The building-block approach provides the earliest possible understanding of the munition/target interaction phenomena during the development process and enables required fixes to identified problems to be incorporated at the earliest possible date.

d. Matrix Team Approach. The complexity of LFT&E programs requires that a broad range of technical, programmatic, and management expertise be brought together for the planning, execution, and reporting of that program. A matrix team approach has been found to be the most effective and efficient approach in previous LFT&E efforts for bringing this diverse set of expertise and activities together and ensuring a coordinated and credible LFT&E program. Thus, successful execution of a LFT&E program demands the early recognition of the need for, the solicitation of, the support of, and the continuous involvement of all necessary

activities. Principal team members typically include the system developer, combat developer, independent evaluators, vulnerability/lethality analysts, testers, medical community, intelligence community, and system contractor (as required). Generally, this matrix team will remain in existence throughout the LFT&E program and should be organized as a separate working group under the TIWG. Membership may be expanded or modified as required and as the program evolves.

e. Test Discipline. Strict discipline is required during the test conduct to ensure validity of results and efficient test execution. This discipline includes strict adherence to the HQDA approved Detailed Test Plan (DTP), approval of DTP changes by HQDA, controlled access to the test item, and early reporting of emerging results. Test discipline is discussed in greater detail in Chapter 5.

Section VIII
Roles

1-16. Office of the Secretary of Defense (OSD)

a. The Deputy Director, Defense Research and Engineering (Test and Evaluation) (DDDRE(T&E)):

(1) Serves as the OSD focal point for review, coordination, and approval of LFT&E policy.

(2) Approves LFT&E strategies, in coordination with the Director of Operational Test and Evaluation, as provided in the TEMP and in accordance with (IAW) DoD 5000.2-M.

b. Director, Live Fire Testing (DLFT), Office of the Deputy Director, Defense Research and Engineering (Test and Evaluation):

(1) Ensures that the Services implement all aspects of the legislation covering LFT.

(2) Develops, recommends, and supervises DoD LFT&E policy.

(3) Reviews and recommends approval of Service LFT&E strategies as provided in the TEMP and Service proposed deviations to the approved LFT&E strategies.

(4) Reviews and comments upon Services' Detailed LFT&E Plans and LFT&E Reports.

(5) Monitors the Services' LFT&E program during its conduct.

(6) Conducts an independent assessment of individual Services' LFT&E programs and prepares the Secretary of Defense LFT&E Report to Congress.

(7) Advocates the development of improved instrumentation, methodologies, criteria, and facilities for conducting LFT&E.

(8) Provides a focal point for the identification of requirements for foreign targets and ammunition for LFT.

1-17. Headquarters, Department of the Army (HQDA)

a. The Deputy Under Secretary of the Army for Operations Research (DUSA(OR)):

(1) Serves as the HQDA focal point for review, coordination, and approval of Army LFT&E policy.

(2) Identifies to OSD Army systems with a LFT requirement.

(3) Serves as the Army approval authority of LFT&E strategies as provided in the TEMP and IAW DoD 5000.2-M.

(4) Approves LFT&E IEPs, TDPs, DTPs, and Detailed Test Reports (DTRs); reviews LFT&E Independent Evaluation Reports (IERs).

(5) Approves any deviations to approved DTPs and IEPs.

(6) Authorizes and coordinates the transfer of validated LFT data to the DLFT or his designated representative(s) on a mutually agreed upon schedule. (Validated data are raw data which have been subjected to a quality control review).

b. The Director for Program and Vulnerability Assessment, Office of the Assistant Secretary of the Army (Research, Development, and Acquisition):

(1) Provides the Army Acquisition Executive (AAE), Army System Acquisition Review Council (ASARC) Members, and Program Executive Officers (PEOs)/PMs results of independent assessments of analytical, test and evaluation, countermeasures (CM), counter-countermeasures (CCM), and vulnerability (including LFT&E) issues on programs before all milestone decision reviews.

(2) Provides guidance, policy, and direction with respect to CM/CCM, vulnerability, and survivability for all AAE programs.

(3) Oversees vulnerability programs throughout Army.

c. Deputy Chief of Staff for Intelligence (DCSINT):

(1) Ensures Defense Intelligence Agency (DIA) approved threat characteristics are provided to support design, development, and validation of threat surrogates.

(2) Approves threat surrogates.

d. Program Manager (PM):

(1) Informs DUSA(OR), through TEMA, of system LFT&E requirement. If system does not have LFT&E requirement, PM so identifies in the TEMP.

(2) Provides membership to the LFT&E working group.

(3) Provides required resources (funding, to include that required for acquisition of targets and threat ammunition; spare parts; etc.).

(4) Recommends, during LFT&E vulnerability testing, whether shots deemed catastrophic should be conceded.

(5) Provides required information on system configuration.

(6) Provides system contractor support, as required.

(7) Assures that all User directed design fixes identified during LFT&E are, within program constraints, developed and implemented.

1-18. Army Materiel Command (AMC)

a. Headquarters, AMC:

(1) Provides LFT&E oversight and ensures support of AMC activities.

(2) Ensures LFT&E guidance is staffed and incorporated in appropriate Army policy and procedural documents.

b. Army Materiel Systems Analysis Activity (AMSAA):

(1) Forms and leads the LFT&E working group under the TIWG.

(2) Serves as lead organization for the development of the LFT&E strategy and the preparation of the TEMP section.

(3) Identifies and defines critical vulnerability and/or lethality issues and ensures issues are incorporated in the TEMP and the LFT&E IEP/TDP.

(4) Develops LFT&E IEP/TDP.

(5) Develops LFT&E IER as a separate stand-alone companion document to the DTR. Ensures IER is completed in a timely manner to meet LFT&E milestone requirements.

(6) Defines threat surrogate requirements, coordinates these with the LFT&E working group, and provides a list of proposed surrogates to the intelligence community for their approval.

c. U.S. Army Research Laboratory (ARL):

(1) Survivability/Lethality Analysis Directorate(SLAD):

(a) Serves as the principal activity in the Army for determining the survivability/lethality and vulnerability (SLV) of Army systems to the full spectrum of battlefield threats.

(b) Acts as the Army focal point for technical advice and consultation on vulnerability and lethality matters for decision makers, system managers and developers, users, testers, independent evaluators and other SLV customers.

(c) Provides independent technical judgements on complex technical issues regarding the SLV of Army systems.

(2) SLAD Integration Office:

(a) Serves as the AMC spokesman on SLV for the Director at major milestone decision points.

(b) Ensures appropriate AMC support is provided to vulnerability/lethality assessments and LFT&E programs.

(c) Provides membership to the LFT&E working group.

(d) Ensures data and lessons learned from LFT&E are incorporated into vulnerability/lethality assessment techniques and supporting data bases.

(3) Ballistic Vulnerability/Lethality Division (BVLD):

(a) Serves as the Army lead laboratory for conventional ballistic vulnerability/lethality assessments.

(b) Provides membership to LFT&E working group.

(c) Assists AMSAA in identification of critical vulnerability/lethality issues and in the development of the test design and data requirements.

(d) Develops and improves vulnerability/lethality assessment techniques to include incorporation of LFT&E lessons learned in assessment techniques and supporting data bases.

(e) Conducts vulnerability/lethality assessments for decision reviews; provides pre-shot predictions/ assessments for LFT&E. Prepares Pre-Shot Prediction Report.

(f) Leads crew casualty and system damage assessments. Prepares Detailed Damage Assessment Report.

d. U.S. Army Test and Evaluation Command (TECOM):

(1) Headquarters

(a) Plans, coordinates, and manages the execution of LFTs.

(b) Provides membership to the LFT&E working group.

(c) Assists AMSAA in the development of the LFT&E strategy.

(d) Manages preparation of the DTP and the DTR for those LFTs assigned for execution.

(e) Reviews the DTP and DTR for those LFTs assigned to other agencies for execution.

(2) Combat Systems Test Activity (CSTA):

(a) Serves as the TECOM Center of Excellence for LFT.

(b) For assigned tests:

1 Plans and conducts all required test efforts including instrumentation, execution, target repair, and maintenance.

2 Serves as lead for preparation of DTP and DTR.

3 Documents test results and supports damage assessment process.

(c) Monitors tests conducted at other installations.

e. Project Manager for Instrumentation, Targets and Threat Simulators (PM ITTS):

(1) Implements Army and AMC policy for the management, control, operation and support (O&S) of foreign assets to include those used in support of LFT&E.

(2) Interfaces with other DoD agencies and enters into Memorandum of Agreement/Understanding (MOA/MOU), as necessary, for the O&S of foreign assets to include those used to support LFT&E.

(3) Assess requirements for the use of foreign assets to support LFT&E and forwards recommendations and/or requests for destructive testing to the Army Foreign Materiel Review Board.

1-19. Other Army Components

a. Training and Doctrine Command (TRADOC) (Centers and Schools):

(1) Serves as lead for the Battlefield Damage Assessment and Repair (BDAR) team.

(2) Participates in preparation of DTR.

(3) In coordination with PM, identifies fixes that result from LFT&E and establishes implementation priority.

b. Medical Research and Development Command:

(1) Assists in the development of LFT plans to ensure medically relevant issues are addressed.

(2) Assists in identification of critical crew vulnerability issues and in the development of the criteria for casualty assessments.

(3) Develops and improves crew vulnerability assessment techniques to include incorporation of LFT&E lessons learned in assessment techniques and supporting data bases.

(4) Provides assistance as required in crew casualty assessments; reviews, in a timely manner, the final casualty assessments to ensure medically relevant concerns have been adequately addressed.

c. Operational Test and Evaluation Command (OPTEC): As required, provides membership to the LFT&E working group.

Chapter 2
LFT&E Strategy

Section I
Introduction

2-1. General

a. The development and subsequent approval of the LFT&E strategy is the single most important step in the overall LFT&E process. The LFT&E strategy is a documented concept that describes who, what, why, when, where, and how the LFT&E requirements for a given system will be satisfied. Just as a system's acquisition strategy outlines the top level approach for the overall system acquisition, the LFT&E strategy provides the top level description of the LFT&E portion of the system acquisition and is an integral part of the TEMP. Once approved, the LFT&E strategy provides the basic roadmap for what vulnerability/lethality testing and evaluation has to be conducted prior to transitioning to full-rate production.

b. While the details of the LFT&E strategy will vary from system-to-system, this Part attempts to provide the general details necessary for the development of an adequate and credible LFT&E strategy. Development of the LFT&E strategy requires both an understanding of the system's acquisition strategy and the overall T&E process. An overview of the T&E process is provided in Part One.

Section II.
LFT&E in the Acquisition Process

2-2. Materiel Acquisition Process

Figure 2-1 depicts where the elements of the required vulnerability/lethality assessment and the LFT&E program fall within the materiel acquisition process as outlined in DoDI 5000.2. Table 2-1 presents an outline schedule of LFT&E events which, if followed, will result in a timely and effectively executed LFT&E program. The schedule for the DTP, DTR, and IER are OSD mandated requirements .

(Insert Figure 2-1)

Table 2-1. LFT&E Schedule

Schedule	LFT&E Event		Lead
Pre-MS I	LFT&E Working Group Formation		AMSAA
MS I	Initial LFT&E TEMP Input:	Strategy Resources	AMSAA PM
MS II	Detailed LFT&E TEMP Input:	Strategy Resources	AMSAA PM
T-180	LFT&E IEP/TDP		AMSAA
T-60	Army Approved LFT&E IEP/TDP, DTP, and Pre-Shot Prediction Report to OSD		DUSA(OR)
T	LFT		Tester
T+60	LFT&E DTR		TECOM
T+110	LFT&E IER		AMSAA
T+120	LFT&E DTR and IER to OSD		DUSA(OR)
T+180	Detailed Damage Assessment Report		SLAD/BVLD

MS = Milestone

T-i or T+i are documentation time requirements (in i days) relative to the initiation (T-i) or completion (T+i) of LFT, respectively. The Detailed Damage Assessment Report is not required prior to the full-rate production decision.

Section III
LFT&E in the T&E Process

2-3. General

Live Fire Tests are part of developmental tests of system vulnerability and lethality. What has changed from previous developmental tests is that a more comprehensive full-up system test with OSD oversight is required before a program may enter full-rate production. The LFT&E program examines the full spectrum of battlefield threats, to include overmatching threats, as opposed to the design level threats considered in previous developmental tests. The scope of LFT&E should build upon early developmental tests of component and system vulnerability and lethality and modeling. Resource and schedule constraints and the stochastic nature of LFTs limit the scope of these tests to a demonstration of

system vulnerability and lethality.

2-4. Factors Addressed in T&E
System developmental tests and evaluations typically address the following factors: firepower (lethality is an element); survivability (vulnerability is an element); performance; reliability, availability, maintainability, and durability; manpower and personnel integration; integrated logistics support; and software. The LFT&E program addresses elements of firepower and survivability; firepower and survivability are compared/contrasted in Table 2-2.

Table 2-2. Elements of Firepower and Survivability

Firepower	Survivability
• Ability to acquire targets	• Avoid or reduce acquisition
• Ability to hit an acquired target	• Avoid or reduce being hit given an acquisition
• *Ability to kill a target given a hit (lethality)*	• *Avoid or reduce being killed given a hit (vulnerability)*
•• *Ability to perforate or breach target*	•• *Protect against lethal mechanisms*
•• *Ability to do significant damage to the target*	•• *Limit damage to crew and hardware*
• Rate of aimed fire	• *Design for expedient repair of combat damage*

Italicized entries are focus of LFT&E.

2-5. System Performance
Both lethality and vulnerability LFT&E address system performance given a munition impact. At the sub-element level, lethality LFT&E addresses both the ability to perforate or breach the target and to do significant damage to the target. Vulnerability LFT&E addresses both being protected against lethal mechanisms and minimizing damage to the crew and hardware given an impact or breach by a lethal mechanism. In addition, vulnerability LFT&E addresses repairability of combat damage (another element of survivability).

2-6. Differences between Vulnerability and Lethality LFT&E
There are several subtle differences in vulnerability/ lethality LFT&E. Vulnerability LFT&E must address crew, hardware (excluding crew), and system (crew and hardware) vulnerability for threats and impact conditions that the system is designed to protect against and for threats and impact conditions that the system is not designed to protect against but could encounter on the battlefield. In lethality LFT&E, it is sufficient to address lethality against the threat system for areas that have the greatest protection and/or where differences between competing munitions are expected (not only areas of greatest protection). For example, a new munition may not be able to breach the area of greatest protection on the threat; however, for areas that it can breach, the damaging effects (probability of kill given a hit ($P_{k/h}$)) may be significantly greater than the munition being replaced.

Section IV
Developing the LFT&E Strategy

2-7. General
The LFT&E strategy is the most important element of the LFT&E process. It should be prepared and approved as early as possible in the acquisition cycle (see Table 2-1). The AMSAA has the lead for preparing and obtaining approval for the strategy in coordination with TIWG members. The DUSA(OR) approves the strategy for the Army before it is sent (via the TEMP) to the DLFT for OSD approval. If consensus on the scope of the LFT&E cannot be reached, or if program constraints limit compliance with required reporting dates, these issues will be raised to the DUSA(OR) for resolution. The strategy is the foundation of the LFT&E section of the TEMP and all subsequent planning documents (the IEP/TDP prepared by AMSAA, the Pre-Shot Prediction Report prepared by SLAD/BVLD, and the DTP whose preparation is managed by TECOM). The strategy should be detailed enough to adequately project resource requirements and trigger long lead time planning, procurement of threats/surrogates, and modeling.

2-8. Steps to take
The first step in preparing a strategy is to do the necessary homework to:

a. Understand the technical and operational characteristics of the concepts, technology, and requirements for the system being developed and how they differ from the system being replaced.

b. Develop a rationale for which threats are to be considered in the LFT&E. The rationale should be based upon a review of the STAR, the densities of the various classes of threat weapons in organizations likely to be encountered, and the frequency that various threats kill or are killed by the system from force effectiveness analyses supporting program decisions or planning studies. An accepted rationale from an approved vulnerability LFT&E plan was to break threats into major and minor threats. A major threat was either one that killed a large percentage of the systems in the force effectiveness evaluation or had a high density in the force; all others were considered minor threats. Most of the shots fired in vulnerability LFT&E should be with major threats. The rationale for lethality LFT&E should be based on the threat that is driving the design (usually the most difficult target to kill given a hit).

c. Review previous LFT or JLF results for the system being replaced. If vulnerability tests have been conducted, repeating some shots with the system being developed may significantly reduce or eliminate the need for comparison tests with the system being replaced. Previous LFT and JLF tests may have identified vulnerability issues that need further exploration or designs that could reduce system vulnerability. This should influence the scope of the vulnerability LFT. For example, during developmental testing of the M1A1 Abrams Tank, damage caused by ballistic shock from nonperforating impacts was identified as a potentially significant vulnerability of the tank. The Vice Chief of Staff of the Army directed a ballistic shock test of the M1 tanks in production. That test identified design fixes that were incorporated into the M1A1 design. The Abrams Vulnerability LFT evaluated how well the design modifications worked.

d. Identify, for lethality LFT&E, threat target requirements and availability. The PMs are responsible for funding the acquisition of targets for lethality LFT&E (see Section V and Chapter 10 for threat target alternatives). In the past, JLF targets have been made available to support LFT&E testing. Providing developmental rounds to fire in JLF tests may satisfy some or all of the full-up threat target portion of the lethality LFT&E requirement. In addition, it may be possible to infer that the developmental round would be at least as lethal as similar

(less capable) rounds fired in the test. This could be used as a justification for firing fewer developmental rounds in LFT&E. An additional potential source of threat targets for use in LFT&E is PM ITTS, the AMC management agent of foreign materiel assets used in support of testing. (See Part 8 for procedures for the acquisition of targets through PM ITTS to support LFT&E.)

2-9. Critical Issues
Having completed the homework on the developmental system, the next step in developing a strategy is to define the critical issues (test issues). Critical issues are not unique to the LFT&E phase, but are issues which are developed to address overall system vulnerability and/or lethality, (i.e., they are vulnerability/lethality critical issues). The LFT&E program will address specific elements of the overall system vulnerability/lethality issues. Critical issues vary for vulnerability and lethality and generally should address the following:

a. Vulnerability LFT&E:

(1) Crew, hardware, and system vulnerability.

(2) Known vulnerabilities and vulnerability reduction techniques (e.g., increased ballistic protection, less sensitive munitions, and redundant components).

(3) Potential vulnerability reduction techniques.

(4) Processes, provisioning, repair times, and training required for BDAR.

Testing should also provide valuable inputs and a basis for refinement and calibration of vulnerability and Sustainability Predictions for Army Requirements for Combat (SPARC) models.

b. Lethality LFT&E:

(1) Ability to perforate or breach the protection of the threat system.

(2) Ability to significantly degrade the combat/mission functions of threat systems given a breach.

(3) Potential lethality improvements.

Testing should also provide valuable inputs and a basis for refinement and calibration of lethality models and data bases.

2-10. LFT&E IEP/TDP
During the examination of the vulnerability/lethality of the system being developed and the defining of the critical issues, the process by which the LFT&E results will be evaluated is formulated. The next step in the strategy development is the finalization of the evaluation process and the articulation of the details of this process in the LFT&E IEP/TDP document. This document will identify procedures to be followed in the evaluation (e.g., statistical analyses, criteria, models, system comparisons, shotlines) and define data requirements. During development of the LFT&E strategy and the resultant IEP/TDP, the total vulnerability/lethality assessment process must be considered. The evaluation must crosswalk the developmental, component, sub-system, etc., vulnerability/lethality testing and assessments with LFT&E requirements. Some aspects of the assessment process which must be examined in the development of the LFT&E strategy are:

a. Early in the system acquisition cycle there is little or no test data and the evaluations are made based upon model estimates. Data bases to support the models should reflect the technical and performance characteristics of the system and the threat. The initial models and model inputs will probably be both unrefined and uncertain. The LFT&E strategy should be designed to increase the level of refinement and to reduce the uncertainty.

b. Models for both vulnerability and lethality evaluations require similar inputs. A detailed description of the system is required for a vulnerability assessment. A detailed description of the threat target is required for a lethality assessment. These descriptions must geometrically describe the location of the critical components, crew, and protective system. In addition, one or two other sets of data is required: a damage assessment list (DAL), or a degraded states analysis. The DAL provides the expected loss of combat function (e.g., mobility or firepower) associated with damage to components and crew. The DAL must be developed by vulnerability analysts and system users. A degraded states analysis relates damage to components and crew to an expected loss of system capability. (Unlike the DAL process, degraded states analysis makes no attempt to relate loss of capability to some combat utility, thus avoiding averaging over some spectrum of mission scenarios. The only difference between degraded states and the DAL is that degraded states analysis allows the user to apply his own mission profile, rather than using the one implicit in the DAL). Finally, the ability of the system's protective system to withstand an impact by the threat; the characterization of the damaging capability of the threat that breaches the protective system; and the susceptibility of the components and crew to the threat damage mechanisms are required. Comparable information is required on threat targets for lethality

evaluations.

c. Vulnerability developmental tests must be planned to assess the ability of a system's protective system (e.g., armor) to withstand impacts by threat missiles and projectiles and to examine the ability of critical components (e.g., ammunition compartments) to withstand damage from a threat warhead or projectile that breaches the protective system. During the Demonstration and Validation Phase, the developmental tests will focus on components. During EMD and production qualification testing (PQT), complete systems should be tested; however, developmental tests should be planned to upgrade and develop the system vulnerability model. The vulnerability LFT is the last vulnerability developmental test and should be conducted against a full-up (combat-loaded) production system.

d. Lethality developmental tests must be planned to assess the ability of the system to damage critical components and the crew. During the Demonstration and Validation Phase, the tests will usually focus on the warhead's or penetrator's ability to breach the threat target's protective system. During EMD and PQT, impact conditions will be firmly established for the missile or projectile and the ability of the warhead or penetrator to breach the threat targets protective system will be refined. The lethality LFT is again the last developmental test and should be conducted against a full-up (combat-loaded) threat target. It is unlikely that the required threat target will be available. (The Army develops munitions/missiles to "defeat" projected threats which in most cases have not been fielded). Therefore, surrogate targets will have to be developed or JLF and/or available threat targets will have to be used. In either case, the scarcity of lethality LFT targets and their cost may dictate that these targets not be fully combat-loaded to preclude an unexpected catastrophic loss.

e. Vulnerability models are also used to estimate the spare parts and time required to repair combat damaged components. Vulnerability LFTs provide valuable inputs for refining these estimates. In addition, rapidly returning damaged systems to battle requires being able to accurately assess the damage and apply field expedient repairs. Again vulnerability LFTs provide both valuable training and opportunities to refine and develop field expedient repair methods and to identify tools and materials required to execute these repairs.

Section V
Threat Targets and Munitions

2-11. Requirements

An integral part of LFT&E strategy development is the identification of the threat target (lethality LFT) and munition (vulnerability LFT) requirements. These requirements need to be identified early-on in the acquisition cycle to allow for possible long lead times for procurement. It is very unlikely that the required threats will be available for LFT. It is also unlikely that any hard intelligence data will be available on the threat's physical and performance characteristics. Therefore, LFTs will probably be conducted using threats based upon postulated technology options derived from intelligence assessments. This will require surrogates in lieu of "real" threats. The rationale for threat surrogate selection must be detailed in the IEP/TDP.

2-12. Rationale for Vulnerability

The rationale for selecting surrogate threat projectiles for vulnerability LFTs is to match physical and performance characteristics of the projected threat. For kinetic energy projectiles, penetration into rolled homogeneous armor (RHA); muzzle velocity and impact velocity; and penetrator material, length, and diameter are key parameters. For shaped charge warheads, penetration into RHA; impact velocity; and warhead diameter, explosive type, material, and diameter are key parameters. Availability and cost of surrogate projectiles may also drive the selection. Typically, U.S. projectiles and warheads will be selected as surrogates. The U.S. projectiles and warheads selected as threat surrogates must be submitted, along with the supporting rationale, by AMSAA to the DCSINT, HQDA, for approval.

2-13. Rationale for Lethality

The rationale for selecting surrogate targets for lethality LFTs is the same as that for selecting surrogate projectiles or warheads. However, selecting and obtaining surrogate targets is much more difficult and expensive than selecting and obtaining surrogate projectiles and warheads. It is the pacing item and probably the most difficult part of executing lethality LFT and, as such, must be addressed and identified early in the LFT&E planning process. This problem was recognized by the DLFT and the DUSA(OR). The AMSAA was requested to chair an Army working group (AMSAA, BRL, TECOM, and VLAMO) to develop guidelines for generic classes of threat target surrogates to satisfy long-term requirements. The Army working group prepared two papers that identified and evaluated alternatives for threat tank and helicopter targets for LFT&E. These papers have been approved by the DUSA(OR). Details can be found in Chapter 7. In the following paragraphs, a brief summary of each paper is provided.

NOTE: Since the publication of these papers the Army has established PM ITTS under AMC. The PM ITTS function is to act as the AMC management agent of foreign materiel assets used in testing. If PMs require PM ITTS support, they must identify their target requirements (including LFT&E) early in

the development cycle (by MS I).

2-14. Tank Alternatives

Eight T&E alternatives were identified for anti-tank munitions in terms of the type of target utilized in the lethality LFT, whether the target functions (i.e., mobility, firepower, etc.), what the test addresses (i.e., armor perforation, damage mechanisms, components), and the basis for the overall lethality assessment (i.e., test, model). The eight lethality T&E alternatives break logically into three groups:

a. Functioning tanks with an overall lethality assessment based upon test results.

b. Ballistic hull and turret (BH&T) with the crew or crew and components represented by boxes with a limited overall lethality assessment based upon test results.

c. A BH&T only or range targets with no overall lethality assessment based upon test results.

2-15. Recommended Tank LFT&E Approach

None of the alternatives by themselves is adequate for lethality LFT; however, it is possible to utilize three different targets to adequately demonstrate lethality in LFTs. The three different targets and the types of tests recommended are as follows:

a. Threat tank range target tests with sufficient sample sizes to establish (with high statistical confidence) the ability of the baseline and developmental anti-armor munition to perforate the range targets of interest and to characterize the behind-armor debris (BAD) characteristics of both munitions.

b. A BH&T target constructed to threat armor projections and configured with crew and major component box representations to demonstrate major lethality differences between baseline and developmental anti-armor munitions.

c. An older threat or U.S. tank (without modifications) to provide a limited demonstration of lethality of the baseline and developmental munitions against a functioning vehicle. (Note these tests may not demonstrate significant differences because both munitions may significantly overmatch these targets.)

2-16. Helicopter Alternatives

Four T&E alternatives were identified for anti-helicopter munitions. The four alternatives for lethality LFTs are:

a. Flyable/functioning helicopters with an overall lethality assessment based upon observation of test results.

b. Non-flyable/functioning helicopter targets with an overall lethality assessment based upon a combination of modeling (principally to define intercept and fuzing/detonation points) and test data (collection of damage effects data).

c. Non-flyable/non-functioning helicopter targets with an overall lethality assessment based upon a combination of modeling (defining intercept and fuzing/detonation points and damage effects on non-functioning components) and test results (collection of damage effects data).

d. Fuselage or major sub-systems representative of comparable threat helicopter components (i.e., engine, rotor system, etc.) with an overall lethality assessment based primarily upon modeling.

2-17. Recommended Helicopter LFT&E Approach

Again the recommended approach for lethality LFT of anti-helicopter munitions is a combination of two target types:

a. Non-flyable/non-functioning helicopters and fuselage or major sub-systems built based upon threat helicopter technical projections.

b. Flyable/functioning and non-flyable/functioning older threat or U.S. helicopters.

Section VI
Shot Selection Process

2-18. Identification

In order to provide the appropriate information required to address critical LFT&E issues, the attack conditions and the munition/target impact location (i.e., shotline) must be identified for each shot. The shotlines selected and the rationale for their selection must be included in the IEP/TDP. There are two types of shots: engineering and random. Engineering shots provide information and data to address specific vulnerability or lethality issues for a specific threat. Random shots are selected from the combat distribution of impact conditions (direction, location, and range) for the threats of interest. The minimum number of

engineering shots should be selected first to address the vulnerability and/or lethality critical issues. Next, the number of random shots required for each threat weapon should be selected. Random shots should be reviewed to determine if any engineering shots are duplicated or if a critical issue is satisfied by a random shot. Those engineering shots duplicated by a random shot should be eliminated. Finally, if the system being developed is to replace an existing system, shots against the system being replaced should be added to enable system comparisons.

2-19. Questions to be Answered
In order to select LFT&E shots, the answers to the following questions must be known:

a. What are the characteristics of the system being developed and the system being replaced?

b. What are the differences in system characteristics that could influence vulnerability or lethality?

c. What is the current state of knowledge about system vulnerability or lethality?

d. What are the critical issues?

e. What are the threats?

f. What are the physical and performance characteristics of the threats?

g. If threat systems are not available, then what is the rationale for threat surrogates?

h. What vulnerability or lethality technical testing has been planned/conducted prior to LFT?

i. Has JLF or vulnerability/lethality testing been done on the system being replaced?

j. What are the program and test constraints?

k. Has any high level guidance been provided?

2-20. Additional Discussion
Questions a through i have been discussed previously; question h is also discussed below to reemphasize its importance. Questions j and k will be discussed briefly before outlining the parameters to be considered in selecting LFT&E shots.

a. Ideally system program schedules and funding should be developed based upon detailed LFT&E planning; however, early in the acquisition cycle, the level of planning is usually unrefined and decisions are made that lock in schedules and funding levels. The LFT&E program should be planned independent of constraints and then efforts must be made in developing and approving the strategy to obtain relief from schedule and resource constraints. The most likely outcome of this process is compromise and trying to work out strategies that meet the spirit and intent of the law within existing or modified constraints.

b. Test facilities may constrain LFTs. There may be a need for new facilities or instrumentation. Time and money may not be sufficient to develop new facilities. In addition, there may be competing demands for LFT facilities for concurrent system developments.

c. High level guidance is frequently provided on the number or percentage of random shots, threats to be included in the test, conditions to be fired, test design and statistical tests to use in the evaluation (e.g., pairwise comparison using the Sign Test), vulnerability or lethality issues to be assessed, and test methods. This guidance must be taken into account explicitly in developing the strategy. If the guidance cannot be accommodated then the rationale for not addressing it must be presented.

d. The other major constraints are the availability of threat projectiles for vulnerability tests and threat targets for lethality tests. For developmental systems, it is almost a certainty that threat projectiles and threat targets will not be available or, if they are, that they will be available in very limited quantities. Developing a rationale for surrogates that is practical (in terms of availability and cost) is important, especially for lethality LFT&E.

2-21. Parameter Selection
For each munition/target combination, the following parameters must be selected and specified: range, angle of attack, and point of impact. For engineering shots, the procedure for selecting these parameters is straightforward; select the threat and the required parameters to address a specific vulnerability/ lethality issue. For random shots, the procedure is based on random selections from "battlefield" distributions of the appropriate parameters. The Board on Army Science and Technology (BAST) developed a methodology for selecting random shots for the Bradley Live Fire Vulnerability Test. The BAST methodology was revised for the Abrams Vulnerability LFT to better distribute the random shots over the entire vehicle when the sample size was small. The revised random shot methodology was reviewed and approved by members of the BAST.

This methodology should be considered for future LFT&E programs. The random sampling parameters for direct fire threats versus an armored target are:

a. Posture (attack or defense).

b. Range (based upon attack or defense posture).

c. Angle of attack (stratified into equal probability intervals to ensure sampling over all possible attack angles with small sample sizes).

d. Target side (left or right).

e. Hull or turret.

f. Horizontal dispersion.

g. Direction of horizontal dispersion (left or right).

h. Vertical dispersion.

i. Direction of vertical dispersion (up or down).

2-22. Exclusion Rules
Exclusion rules may also be established for rejecting random shotline draws. Typically, these exclusion rules for armored targets reject shots that:

a. Do not impact turret or hull armor.

b. Are a repeat of another random shotline.

c. Are a repeat of a previous full-up vehicle shot.

2-23. Parameter Modification
The sampling parameters for random shot selection must be modified as a function of weapon class (e.g., direct fire weapons, indirect fire and top attack weapons, mines). For example, none of the preceding parameters apply for pressure activated mines. For pressure activated mines, the sampling parameters would include right or left track and the location under the track.

Chapter 3
LFT&E Review and Approval Process

Section I
Introduction

3-1. General
Figure 1-1 provided an overview of the LFT&E process from initial strategy definition to the distribution of the final test report(s). Key to that process is the review and/or approval of the strategy, T&E plans, and test reports by senior decision makers within HQDA and OSD. The LFT&E review and approval process builds upon the existing T&E review and approval process and ensures that the "chain-of-command" is not only kept informed of, but, also approves all aspects of the LFT&E program for a given system. This review and approval process will ensure an adequate vulnerability/lethality assessment and provide the development community the necessary information to conform to the latest AAE ASARC review process guidance, i.e., pre-ASARCs and ASARCs will include a briefing covering the assessment of the vulnerability and CM/CCM of the system.

Section II
Test and Evaluation Master Plan

3-2. General
a. The TEMP is the basic planning document for all T&E and is the document by which the Army formally coordinates and approves the LFT&E strategy for a given system and communicates that strategy to OSD. The preparation and processing of TEMPs is conducted under the auspices of the TIWG. (See Volume 1 for guidance concerning TEMP procedures and formats to be followed in the TEMP preparation). The TIWG provides the forum to affect coordination and resolve problems in the LFT&E process. A separate LFT&E working group (which AMSAA chairs) under the TIWG is formed to prepare the LFT&E strategy and the LFT&E input to the TEMP. A smaller group combined with the classified nature of LFT&E enables these items to be developed in a more timely and efficient manner. Additionally, the LFT&E working group may assist in any required briefings of the LFT&E strategy to HQDA and OSD.

b. The TEMP (PART III DEVELOPMENTAL TEST AND EVALUATION, paragraph d, <u>Live Fire Test and Evaluation)</u> shall contain the LFT&E strategy for the program throughout its materiel acquisition process. The TEMP summarizes what, why, who, where, when, and how the LFT&E issues will be tested and evaluated. All LFT&E which

impacts on program decisions will be outlined in the TEMP. The TEMP shows the relationship of the LFT&E issues to the required technical and operational characteristics; describes the critical vulnerability/lethality issues and evaluation criteria; outlines the planned LFT&E; discusses the amount and type of LFT&E that will be performed to support each program decision point; and indicates where schedule, resource, or budget constraints may impact the adequacy of planned LFT&E. Specific items to be addressed in the TEMP includes a description of the following items:

(1) The overall LFT&E strategy.

(2) Related prior and future LFT&E efforts.

(3) The evaluation plan.

(4) The major test limitations.

(5) The shot selection process.

c. The primary LFT&E resource requirements should be identified and addressed in the T&E Resource Section of the TEMP as early as possible (to facilitate budget/schedule projections); initial resource requirements should be identified prior to the Milestone I decision. This will ensure that adequate time is allowed for long lead items such as targets for lethality tests and threat munitions for vulnerability tests. Additionally, it ensures the early identification and programming of the funds required for test execution.

3-4. Review and Approval
Since the LFT&E strategy is part of the TEMP, the review and approval process established for the TEMP (see Part Two) necessarily applies to the LFT&E strategy. Specifically, AMSAA, in coordination with the TIWG, develops the LFT&E strategy and incorporates it into the TEMP. Upon completion of initial coordination but prior to formal TEMP submission to HQDA, it is advisable to brief the LFT&E strategy to the DUSA(OR) to solicit initial guidance/agreement in principle on the proposal.

NOTE: Any acquisition category program with a LFT&E requirement is necessarily on the OSD oversight list (even if just for LFT&E purposes), and thus such program's TEMP must be submitted to HQDA for approval prior to submission to OSD (see Part Two).

3-5. Issue Resolution
During the planning and conduct of a LFT&E program, the TIWG will attempt to resolve all issues. Those issues which cannot be resolved by the TIWG will be forwarded through the PEO/PM to the DUSA(OR) for final resolution. In some cases, issues may be raised

during the conduct of the LFT&E program which require off-line tests or additional full-up firings. In all cases, any additional firings must be approved by the DUSA(OR).

3-6. Waiver

a. The LFT&E legislation contains a provision which allows the Secretary of Defense to waive the requirement for full-up LFT&E, if the Secretary of Defense certifies to Congress that such LFT&E would be unreasonably expensive and impractical. In time of war or mobilization, the LFT&E requirement may be suspended by the President. A request for waiver must be submitted and approved prior to the Milestone II decision. The review and approval process for waivers is as follows:

(1) The request for waiver is prepared by the PM and must include the strategy which will be followed in assessing overall system vulnerability/lethality in lieu of full-up testing and an assessment of possible alternatives to realistic system testing.

(2) Request for waiver is submitted by the PM to the TIWG for coordination and approval.

(3) Upon TIWG approval, the PEO/PM submits the request for waiver through the DUSA(OR) for review and approval by the AAE.

(4) Upon approval by the AAE, the DUSA(OR) submits the request for waiver through the DDDRE(T&E) to the Undersecretary of Defense for Acquisition for approval by the Secretary of Defense.

b. The waiver process should normally be considered a last resort in addressing the full-up LFT&E requirement. The LFT&E Guidelines issued by OSD and endorsed by the DUSA(OR) provide sufficient latitude for a broad range of systems configurations to satisfy the LFT&E requirement without having to resort to a request for wavier. Specifically, the Guidelines allow full-up testing (full-up components, full-up sub-systems, etc.), in lieu of full-up, full-scale system testing in addressing the LFT&E requirement. The development and articulation of a well-planned strategy which takes advantage of extensive component/sub-system/system testing and a limited but reasonable full-up, sub-system/system LFT&E phase can satisfy the LFT&E requirement.

c. A request for waiver in lieu of a limited, full-up sub-system/system LFT&E program can also be perceived by system critics as a cover-up for potential system deficiencies. More importantly, the system users needs to have as complete an understanding as possible of the vulnerability/lethality strengths and weaknesses of a system before they are required to use that

system in combat. Thus, the question should not be "Can we afford to conduct LFT&E?", but "Can we afford NOT to conduct LFT&E?" if we are to ensure that "surprises" are learned during system development and not on the battlefield.

Section III
Independent Evaluation Plan/Test Design PLan (IEP/TDP)

3-7. Defining Critical Issues

The IEP/TDP defines the critical issues that form the basis for the LFT&E program and provides the crosswalk between the critical issues and the data requirements. Additionally, the data sampling plan and analysis techniques are specified to ensure the logic of the evaluation is understandable. The IEP/TDP will include a section describing the types of threats or targets that the system is expected to encounter during the operational life of the system and the key characteristics of the threats/targets which affect system vulnerability/lethality. A reference to the specific threat definition document/authority will be presented with further discussion of the rationale/criteria used to select the specific threats/targets or surrogates and the basis used to determine the number of threats/targets to be tested in the LFT. Any test limitations or shortfalls and their impact on the test will be identified. Furthermore, any previous data that will be used to support the evaluation will be discussed.

3-8. Independent Developmental Evaluator

The independent developmental evaluator prepares the IEP/TDP and addresses all aspects of the evaluation and LFT required to satisfy the critical issues. The IEP/TDP is the responsibility of AMSAA with assistance provided by the other members of the TIWG. It is a stand-alone document and must be developed and then approved by the DUSA(OR) six months prior to test initiation. The approved IEP/TDP will also be submitted to the DUSA(OR) when the DTP is submitted for approval.

Section IV
Detailed Test Plan (DTP)

3-9. Contents

The DTP provides explicit instructions for the conduct of the LFT. It is prepared by the technical tester and is derived from and implements the requirements of the AMSAA IEP/TDP. The exact format can vary depending on the test program but, as a minimum, it should contain individual sections which address the major

categories listed below.

a. Introduction. This section should contain a summary description of the test program, the principal participants and their roles, the test item and its performance characteristics, previous vulnerability or lethality testing, the test objectives, and any other information that supports LFT.

b. Test Conduct. This section covers how the test will be conducted, which threats or targets are being used, what surrogates, if any, will be used, what procedures will be used to ensure test discipline, how threats will be fired/launched, what potential lack of realism may result from absence of components, from use of surrogate components, from the inerting of fuzes on stowed ammunition, etc. A tabular listing of all threats/munitions to be fired and target impact conditions/locations will be provided via summary tables; pictorial representations of each target impact location and attack angle will also be provided. Finally, the procedures to be used for the crew casualty and system damage assessments will be described.

c. Appendices. Individual appendices should be used to address subjects such as:

(1) System Configuration. This appendix describes the target configuration and its fidelity (i.e., BH&T; full-up, target simulants, etc.) and discusses how the test item compares to the actual, combat configured target. All stowage plans for full-up targets will be pictorially presented to show locations and quantity of items stowed on-board (as configured for combat). These stowage plans will be approved, by the combat user for U.S. systems and by the intelligence community for foreign systems, before they are used in the LFT. A more detailed discussion of system configuration is found in paragraph 5.2.

(2) Instrumentation Plan. This appendix describes the instrumentation suite required to record test conditions and measure system response (e.g., projectile striking velocity, fuel temperature, component acceleration, etc.). The tester will define specific instrumentation requirements based on the IEP/TDP data requirements.

(3) Battlefield Damage Assessment and Repair. This appendix defines the level of BDAR to be performed and describes team(s) membership, repair skill level requirements, times for repair, etc. The BDAR team(s) support required will be decided on a case-by-case basis depending on the fidelity of the target. Typically, BDAR team(s) perform crew, organizational support, and/or direct support levels of repairs.

(4) The OPSEC Plan. This plan is included as part of the DTP to ensure that all test participants are aware of the security aspects of the LFT and how the data are to be handled. Furthermore, the high visibility and sometimes controversial nature of LFT requires strict compliance with OPSEC safeguards and a public affairs plan to cover any questions asked by outside activities or private citizens.

3-10. Preparation and Staffing
The DTP is prepared by the tester and coordinated with members of the LFT&E working group. After coordination, two copies of the DTP, along with two copies each of the previously approved AMSAA IEP/TDP and the SLAD/BVLD Pre-Shot Prediction Report, are forwarded to the DUSA(OR) at least 60 days prior to test initiation. The DTP is either approved by the DUSA(OR) or returned to the tester for changes/corrections.

TESTING WILL NOT START UNTIL THE DTP IS APPROVED BY THE DUSA(OR)

3-11. OSD Review
The Army approved DTP, along with the Army approved IEP/TDP, and the Pre-Shot Prediction Report are forwarded to OSD for review and comment; OSD suggested changes are reviewed by the DUSA(OR) and incorporated by the appropriate lead activity as directed by the DUSA(OR). The DTP must also outline the detailed procedures to be followed to accommodate unexpected changes to the LFT that may occur during actual testing. When a change to the approved DTP is required, it is essential that strict adherence to the change procedures be followed to avoid repeating test shots and to dispel any perceptions of fixing the test to achieve desired results. The TECOM takes the lead in coordinating changes to the DTP and ensures these changes are fully coordinated with all participating LFT&E agencies. Written notification of the proposed change(s) is forwarded to the DUSA(OR) for approval. No change from the DTP is undertaken until approved by the DUSA(OR) and provided to OSD for review and comment. After approval, all participating agencies are notified of the change approval. The change will also be documented in the DTR along with the supporting rationale.

Section V
Pre-Shot Prediction Report

3-12. General
The Pre-Shot Prediction Report provides the vulnerability/lethality analysts' best estimate of the expected outcome of each shot prior to the actual test conduct (i.e., a pre-shot prediction). It is a requirement for all LFTs and provides a snapshot of the vulnerability/lethality analysts' current understanding of the munition/target interaction. These predictions can range from subjective engineering judgments of the expected damage level through computer generated estimates of crew casualties and system probabilities of kill (P_ks). The SLAD/BVLD is responsible for generating the pre-shot predictions for each shotline. Appropriate pre-shot prediction techniques will be determined by SLAD/BVLD on a case-by-case basis and will be consistent with the technique planned for casualty/damage assessment. The SLAD/BVLD will prepare the Pre-Shot Prediction Report; it must be submitted to the DUSA(OR), along with the DTP, 60 days prior to test initiation. The Army approved Pre-Shot Prediction Report is forwarded along with the DTP and the IEP/TDP to OSD for review and comment.

3-13. Predictions
The pre-shot predictions are necessary for the following reasons:

a. To ensure useful insights will be gathered about the relative vulnerability or lethality of the system involved.

b. To establish a baseline estimate of the understanding of the munition/target interaction prior to test.

c. To assist in shot prioritization from least to most damaging. This will ensure that most of the testing will be completed before the high risk shots are fired. This works well for both vulnerability and lethality tests since target repair is a major driver in the turnaround time between LFT shots.

Section VI
Detailed Test Report (DTR)

3-14. General
The DTR provides a formal detailed record of the test data and information obtained during the conduct of the LFT and describes the conditions which actually prevailed during test execution and data collection. The test report documents all individual shot test conditions and test results required by and identified in the DTP and approved changes to the DTP. Sixty days after test completion the DTR is provided to AMSAA, to support their

independent evaluation, and forwarded to the DUSA(OR) for approval. The approved DTR and IER must be forwarded to OSD (DLFT) within 120 days after test completion and 45 days prior to the full-rate production decision. Schedules must be planned accordingly to accommodate these mandatory reporting milestones.

Section VII
Independent Evaluation Report (IER)

3-15. General
The IER documents the independent evaluation of the LFT and contains the assessment of the critical issues and conclusions concerning the vulnerability/lethality of the system. The IER is the sole responsibility of AMSAA, the technical independent evaluator. The IER addresses the test objectives, issues, and criteria as defined in the IEP/TDP. It discusses the crosswalk between results and the evaluation and specifies any limitations relative to the analysis. All aspects of the test will be evaluated, both negative and positive. The evaluation will be balanced by the discussion of vulnerability/lethality based on the likelihood of occurrence on the battlefield. The IER is submitted to the DUSA(OR) for review and, together with the DTR, is forwarded to OSD within 120 days after test completion. The IER and all LFT&E reports (to include the OSD report to Congress) must be rendered prior to the Milestone III full-rate production decision.

Section VIII
Detailed Damage Assessment Report

3-16. General
This report documents the detailed analyses and crew casualty and system damage assessments of the individual test events. It includes an in-depth comparison of the pre-shot predictions of crew and system damage and the observed test outcomes. This process requires a detailed examination of component damage states, failure modes, damage mechanisms, etc., to ensure a full understanding of model predictive capability. Anomalies will be identified and, if required, model updates specified. These in-depth analyses will not preclude SLAD/BVLD from providing its required support to the LFT evaluation. The individual shot damage assessment records will be provided by SLAD/BVLD to the tester within 30 days after test completion and subsequently to AMSAA to support its independent evaluation. Within six months after completion of the test, the SLAD/BVLD will publish the Detailed Damage Assessment Report.

Chapter 4
Modeling

Section I
Introduction

4-1. General
a. Much of the early controversy surrounding LFT&E focused on the adequacy of existing Army vulnerability/lethality models and their appropriate role in the overall LFT&E process. Too often people interpreted the debate over these issues in such a manner that modeling and testing were viewed as an either-or proposition. The basic fact is that both are needed and are essential to a comprehensive and effective LFT&E program. They are complementary efforts and the LFT&E strategy and planning must be based on this view. This section will attempt to provide a better understanding of the Army's vulnerability/lethality models and their role in LFT&E.

b. Live Fire Testing, even when supplemented with developmental testing, cannot produce enough data to assess the vulnerability or lethality of a system for all combinations of threat, impact, and engagement conditions. Thus, modeling must be used to extend test results to account for conditions impractical or impossible to test. The reader is reminded that modeling here is defined in the broad sense given in Chapter 1.

Section II
Role of Modeling

4-2. General
In the context of LFT&E, vulnerability/lethality modeling has four basic roles: support test design, support the evaluation of system and crew vulnerability or munition lethality, guide and evaluate vulnerability reduction or lethality enhancement efforts, and methodology diagnosis.

4-3. Test Design Support
Live Fire Testing is expensive and it is absolutely essential that the maximum information be collected with the resources allocated to LFT&E. Modeling is used:

a. To determine which engineering shots make the most sense in terms of what is known about the vulnerability or lethality of the system being tested, the expected performance of the threat munitions or target, and the specific evaluation issues for the system being tested;

b. To develop and apply exclusion rules for randomly selected shots and, once those shots have been selected, to determine from pre-shot predictions which, if any, should be conceded to avoid unnecessary loss of test assets;

c. To "filter" random and/or engineering shotlines to ensure a specified level of damage will be considered (e.g., using LOF matrices to identify weapon/target impact locations which satisfy a preselected criteria that only "shotlines with a LOF greater than or less than a certain value will be considered".

4-4. Evaluation Support
Model outputs, in conjunction with Live Fire and development test results, are used by AMSAA to address critical evaluation issues pertaining to system vulnerability or lethality, crew casualties, and logistic supportability. It is difficult to separate vulnerability or lethality evaluations directly supporting LFT from those required to support the entire acquisition process because, in a broader context, model generated vulnerability and lethality estimates are critical inputs to system effectiveness studies, such as the cost and operational effectiveness analysis (COEA), designed to determine force exchange ratios, optimum tactical deployment schemes, wartime maintenance and medical requirements, and other measures of system cost and benefit.

4-5. Vulnerability Reduction/Lethality Enhancement
Modeling also supports vulnerability reduction and lethality enhancement efforts by allowing the analyst to evaluate the potential payoff of design changes intended to reduce casualties/system vulnerability or increase munition lethality.

4-6. Methodology Diagnosis
One objective of LFT is to determine the extent to which the vulnerability and lethality models account for all pertinent munition damage mechanisms and target failure modes. In this context, modeling, via comparing pre-shot predictions with test results, can provide insights into the fidelity of the models themselves. Seldom will enough data be generated from a single LFT to allow a complete verification of model performance. But, insights can be gained to suggest whether significant munition/target interactions are being neglected by the models and to identify areas of model performance which need to be more thoroughly examined in on-going model improvement programs.

Section III

Assessment Techniques

4-7. Techniques
Vulnerability or lethality modeling can be as simple as using a series of charts to determine whether missile fragments are likely to sever a drive shaft in the LFT, or a subset of the LFT, conducted on a component or sub-system level. At the other extreme, modeling may involve the use of several large scale computer codes to generate distributions of system probabilities of kill given a hit ($P_{k/h}$s) which take into account all known munition/target interaction phenomena and, in addition, address the stochastic nature of these interactions. In general, more than one model must be used to characterize such phenomena as target geometry, munition performance, armor performance, BAD, personnel injuries, component and sub-system failure modes, aircraft airspeed and altitude dependence, and component kill probabilities. Usually, these models are implemented and applied with personal and mainframe computer codes which, depending on their complexity and sophistication, have modules to implement these models or use as input the products of auxiliary codes. It is important to recognize that the choice of models cannot be specified arbitrarily. Rather, the appropriate model or assessment technique must be chosen on the basis of how much is known about the threat munition or target, input data that are available, and perhaps most importantly, the vulnerability or lethality issues that the LFT is designed to address. While the most detailed and sophisticated models consistent with these criteria should always be used, it is not unusual for one suite of models to be most appropriate for pre-shot predictions while another suite of models is best for some other aspect of the LFT&E effort. This flexibility in model selection is especially necessary for lethality LFT&E because the level of knowledge of the threat target is often extremely limited. For any given LFT, be it vulnerability or lethality, the suite of analysis models must be selected by the vulnerability/lethality analyst in coordination with AMSAA. However, once this choice of assessment technique is made, it is important to create an audit trail. The underlying rationale for the model or its modification, model limitations, assessment procedures, and required input data should be documented. The models to be used must, of course, be specified in the IEP/TDP. However, depending on the level of development of the LFT&E strategy, they may or may not be identified in the earliest versions of the TEMP.

Section IV
Data Bases

4-8. General

Regardless of the specific models selected to support any given LFT there are several data bases that must be developed prior to LFT. The exact nature of these data bases will, of course, vary depending on the models actually used. However, they will usually include such things as component $P_{k/h}$s, target descriptions, threat munition and armor performance, BAD characteristics, failure modes and component/sub-system criticality, kill criteria, DALs, helicopter altitude-airspeed diagrams, and the sensitivity of combustibles to fragment and penetrator impacts. Development of these supporting data bases must begin one to two years in advance of the start of the LFT. A potential problem with the scheduling of tests and analyses to generate these data bases is that the data must be pertinent to the planned production design of the system or munition being tested. For example, penetration characteristics for a new projectile must be for the production design as opposed to evolutionary development prototypes. Some of these data bases will be developed wholly or in part to support the overall T&E process; others are needed to directly support LFT. In any event, costs and hardware requirements must be identified as early as possible in the TEMP in order to permit their inclusion in budget and contractual documents.

Section V
Vulnerability/Lethality Estimates

4-9. General

Vulnerability and lethality estimates in the form of $P_{k/h}$s, vulnerable areas, and blast contours are typically generated by, or under the auspices of, the SLAD/BVLD. (For JLF Programs and Army LFT of multiservice equipment or munitions, vulnerability/lethality modeling may be conducted or supported by the Navy or Air Force.) These vulnerability and lethality estimates are essential inputs to system effectiveness studies; they also provide a basis for relative comparisons (e.g., to determine whether the requirement to reduce the average $P_{k/h}$ or vulnerable area by some amount has been met). However, the vulnerability and lethality estimates do not account for combat attack distributions, deployment conditions, or weapon hit probabilities. Typically, AMSAA applies these factors to the vulnerability and lethality estimates to generate P_ks given a shot, burst, etc. These P_ks are then used by AMSAA, TRADOC, or other agencies to evaluate system survivability or firepower to determine force exchange ratios, identify maintenance requirements, or determine some other measure of system effectiveness. Thus, there is clearly a critical link between vulnerability/lethality modeling and system level evaluations. It is evident that vulnerability and lethality analyses must be responsive to the requirements of the system level studies. Conversely, evaluation

strategies must be based on the type, quality, and quantity of vulnerability/lethality estimates that can be reasonably expected to be generated in light of the limitations discussed above. In addition, data requirements must be identified in a timely manner to allow input data bases to be developed and necessary model modifications to be made.

Section VI
Classes of Models/Algorithms

4-10. General

There are a great number of models or algorithms used to support the vulnerability/lethality assessment process. In Table 4-1, three classes of such models are compared for output measure, level of detail, and applications. This table is by no means all-inclusive and is included here to illustrate the primary factors associated with vulnerability/lethality models.

Table 4-1. Comparison of Three Types of Vulnerability Models

Model Type	Output Measures	Level of Detail	Applications
Lumped Parameter (e.g., Compartment)	Expected M-Kill Expected F-Kill Expected M/F-Kill Expected K-Kill	Structure External suspension Compartments (crew, ammo, engine) Crew casualty	COEAs, MAAs, SSEBs, Compartment-level trade-off analyses, Vulnerability reduction
Expected Value Point Burst (e.g., VAST, HEVART)	Same as above plus component P_ks Attrition Forced Landing Mission Abort Repair Times	Structure Suspension Components Crew casualty	Same as above plus component level trade-off analyses, SPARC analyses
Stochastic Point Burst (e.g., SPRAE, SQuASH)	M-kill Pdf F-Kill Pdf M/F-Kill Pdf K-Kill Pdf Component P_ks Component Damage State Pdf	Same as above	Same as above plus estimation of errors in field sampling, propagation of uncertainities, and calibration of lower-level models.

Legend:

F-kill = Firepower kill
K-kill = Catastrophic kill
M-kill = Mobility kill
M/F-kill = Mobility or Firepower kill

HEVART = High Explosive Vulnerable Areas and Repair Times
MAA = Mission Area Analysis
Pdf = Probability density function
SSEB = Source Selection Evaluation Board

SPRAE = Stochastic PRocessor of Artillery Effects
SQuASH = Stochastic Qualitative Assessment of System Hierarchies
VAST = Vulnerability Analysis of Surface Targets

Chapter 5
Test Conduct and Parameters

Section I
Introduction

5-1. General
This section provides general guidance for the conduct of LFT and discusses those parameters and functions which must be considered during test planning (e.g., vehicle stowage, instrumentation, scheduling, etc.); actual test requirements will be established on a case-by-case basis to address the data requirements defined in the IEP/TDP. Guidance presented in this section is based on Army LFT&E experience to date with armor/anti-armor systems; test conduct, test parameters/functions, and terminology discussed in the following paragraphs reflect this experience. Because the primary purpose of LFT&E is to address crew survivability, most of the parameters/functions and the testing discussed in this section is applicable to any type of system and the remaining items are easily extrapolated to other types of systems. Again, the reader is cautioned that, all requirements must be determined on a case-by-case basis.

Section II
Test Item Configuration

5-2. Vulnerability LFT&E

a. Vulnerability LFT&E is conducted to identify potential system integration vulnerabilities which cannot be adequately addressed through component and/or sub-system testing. In order to provide the most realistic test possible and to accurately assess the vulnerability of the system and the survivability of the crew, the weapon system must be as close to its combat configuration as possible. Combat configuration denotes a fully operational test item complete with all sub-systems and on-board stowage items.

b. The presence of a fully operational test item with all sub-systems is particularly important in evaluating ballistic shock damage and the interaction between sub-systems as a result of damage to different components. In order that the individual effects of each shot on the test item can be determined, the test item is repaired and baseline performance characteristics determined prior to each test shot. Baseline procedures should include a complete functional check of all major sub-systems on the test item and may also include performance checks such as mobility or firepower characteristics.

c. Systems undergoing LFT&E testing are stowed in a combat configuration so that the effects of the stowage on the system vulnerability and crew survivability can be assessed. Stowage in a combat configuration includes ammunition, fuel, additional authorized list (AAL) items, and basic issue items (BII). Anthropomorphic simulants and/or wooden mannequins are located in crew positions as an aid in crew survivability assessments. Ammunition should be live, with inert fuzes or fuzes removed (live fuzes damaged during test conduct could present a hazard to test personnel). However, if the reaction correlation between inert and live ammunition is known and predicable, inert rounds may be stowed to ensure survivability of limited assets. The use of inert rounds in lieu of live ammunition will be approved by the DUSA(OR) on a case-by-case basis. Any planned shot which the PM considers to be catastrophic or of significant damage may be conceded; however, conceded shots will be assigned a $P_k = 1.0$ for the evaluation.

d. All fuel in the test item will be at normal operating temperatures for the system at the time of the test firing. This is necessary since the flammability of the fuel increases as its temperature increases. Typically, this is accomplished by adding heated fuel to the test item prior to the test firing.

e. The AAL and BII are stowed on the test item in accordance with an approved stowage plan. Typically the stowage plan is developed by the responsible TRADOC school and verified by the tester prior to testing. Crew simulants are dressed in the appropriate ensemble to include helmet, personal weapons, goggles, gloves, boots, coveralls, ballistic vest, and battle dress uniform, as prescribed by Army doctrine. This assures that the anthropomorphic simulant or wooden mannequin is representative of an actual crew member and that the protective features of the uniform are accounted for in the crew injury evaluation.

f. A hazard analysis is performed on all of the stowage items. Any stowage item which could pose a hazard to test personnel, if damaged during testing, must be modified or replaced. Those items modified or replaced must be listed in the DTP. For example, certain types of chemical detectors used on combat vehicles contain a radioactive isotope as part of the sensor--this isotope would be removed prior to stowing the detector.

5-3. Lethality LFT&E

a. Lethality LFT&E is conducted to demonstrate the effectiveness of U.S. munitions against required or representative threat targets. Targets for lethality LFT&E can include target

simulants (i.e., targets constructed to represent a shotline against a known threat), BAD collection packets to determine residual penetration and spall data, and, if possible, full-up systems. The full-up system could be the actual threat, if available, an available "older" threat, or an approved surrogate (see Chapter 2 and 7). The actual targets and full-up systems to be used are determined on a case-by-case basis and will be specified in the LFT&E portion of the TEMP.

b. As with vulnerability LFT&E, the full-up threat system will be in a full combat configuration (i.e., fully operational and stowed per an approved stowage plan). The full-up system test provides a mechanism for evaluating overall munition effectiveness due to penetration/perforation, spall, ballistic shock, fire, blast overpressure, toxic fumes, etc. The use of inert ammunition in lethality LFT&E is subject to the same conditions given in the preceding paragraph.

5-4. Simulated Targets

In order to preserve valuable threat assets or when threats are not available for lethality LFTs, targets constructed to represent a given threat characteristic can be used in lieu of full-up targets. Tests conducted with these targets should be used to supplement a limited full-up LFT; simulated target tests alone do not provide an adequate demonstration of a system's lethality. Data which can be obtained from simulated target testing (either directly or from modeling efforts) are: profile hole diameters; BAD (fragment mass, velocity, and spatial distribution); residual penetration; and individual P_ks for a selected target impact location. If side-by-side testing of two or more munitions is conducted, statistical tests (e.g., Sign Test, student t-test, etc.) can be used to conduct lethality comparisons.

Section III
Test Assets and Schedule

5-5. General

The LFT is normally the last test to be conducted prior to the full-rate production decision and, as such, planning and resourcing must be addressed early-on in the LFT&E program. The strategy and resource requirements (to include targets/munitions) to accomplish an efficient and effective LFT&E program must be included in the TEMP T&E Resource Section.

5-6. Conduct

Conduct of LFT is driven by the time between shots required to repair the target. Full-up system tests usually require extensive repairs and repair time. Experience indicates that there is a

three-to-one ratio of repair time to test range time. To increase test efficiency and provide maximum utilization of personnel and hardware, it is advantageous to conduct LFTs with multiple target assets. Multiple target assets allow for overlapping of test and repair time, thus, increasing testing efficiency. When multiple test assets are not feasible, the LFT&E schedule must reflect the total time required to complete the testing. If the schedule cannot accommodate these time requirements, it may be necessary to restructure the strategy. Decisions concerning assets, schedules, and strategy are addressed by the LFT&E working group. As with other phases of the T&E process, unresolved issues are forwarded to higher headquarters for resolution.

Section IV
Instrumentation

5-7. Data Collection

Test assets and LFT are expensive; therefore, a complete set of data must be gathered on each shot to facilitate the crew and system damage assessment, to measure and/or record test conditions, and to ensure test conformity (i.e., compliance with the DTP). In addition to instrumentation for addressing crew/system damage, the test item is instrumented to provide early warning of potential problems resulting from the test event. Parameters measured could include: engine rpm, voltage, hydraulic fluid pressures and temperatures, oil pressures and temperatures, coolant temperatures, and automatic fire suppression/fire extinguishing system discharges. Actual instrumentation suites are determined by the tester on a case-by-case basis to address the IEP/TDP data requirements and test item safety/security requirements. These instrumentation packages typically include the following:

a. Video and high speed photography to provide visual documentation of the test event. Video documentation provides real time monitoring of the interior and exterior of the test item. The exterior video also provides assistance in locating parts displaced by the munition/target interaction. The internal video provides real-time information on perforation of the target protective system, the presence and extent of internal fires, and test item status information required for determining when it is safe for test personnel to re-enter the test site.

b. Projectile flight/performance instrumentation to record striking velocity, velocity profile from launch to impact, pitch/yaw history, and penetration characteristics. Video cameras, high speed cameras, and/or flash x-rays may be used.

c. Toxic fumes instrumentation to record the levels of potentially hazardous gases (e.g., nitrous oxide, nitrogen dioxide,

carbon monoxide, carbon dioxide, hydrogen fluoride, hydrogen bromide, cyanide, aldehydes, etc.) and airborne particulates. Toxic fumes data are collected at crew member locations. Specific items and crew locations to be sampled are system dependent and will be determined based on an analysis of the potential hazard posed by on-board materials.

d. Thermal effects instrumentation to record temperature and heat flux data related to the crew and test item. These data are used to assess crew survivability, provide engineering data to assess hardware vulnerability, and ensure compliance with the DTP parameters (e.g., fuel temperature at shot time).

e. Blast overpressure instrumentation to record pressure time histories. Overpressure data are collected in the crew compartment and external to the test item to assist in assessing personnel casualties and to provide engineering data to assess hardware vulnerability.

f. Ballistic shock instrumentation to record accelerations and forces on the crew and critical system components. Accelerometers, strain gages, and/or velocity gages can be placed on components to measure the ballistic shock transmitted through the structure of the test item to the components and on anthropomorphic simulants to measure acceleration and forces transmitted to the crew. The simulants are positioned in crew locations away from the primary penetrator path/spall cone where ballistic shock to crew is of concern. Wooden mannequins can be placed in other crew locations to record the effect of the penetrator/spall cone.

g. Plate arrays and BAD packets to record penetration performance, residual penetration, and spall cone characteristics (i.e., fragment number, size, velocity, and spatial distribution).

Section V
Facilities

5-8. Facilitity Considerations

Live Fire Testing often requires extensive test facility capabilities to allow for realistic and cost effective testing; actual facilities for a given program will be driven by the test and data requirements. Test facility capabilities which could be required to support a given program are:

a. Multimunition Firing. The threat could consist of gun fired rounds, missiles, rockets, mines, etc., requiring a variety of launching capabilities. Threats could require real range firings, reduced range firings, and static firings (e.g., mine

firing in prepared soil with specified density and moisture content). Launch conditions could be direct fire, superelevation (anti-air simulation), and high angle of fall (indirect fire simulation).

b. Instrumentation Suite. Live Fire Testing is instrumentation intensive and could require upwards of 200 channels of data collection during any given shot. Substantial video and high speed film coverage for documentation and test item security could be required.

c. Range/Test Item Security. In addition to video to provide real-time visual security, an auxiliary fire suppression system could be required for protection of range and instrumentation suite facilities as well as test item security. Providing adequate protection to instrumentation cables from fragments and/or fire to ensure test requirements are not compromised must be a prime consideration. Additionally, environmental protection in accordance with federal/state government mandates must be adequately addressed (i.e., Environmental Impact Statements must be developed, staffed, and approved prior to test initiation).

d. Repair Facility. Because test assets are limited and LFT&E test item/target configuration requirements are stringent, the ability to perform repairs will be necessary. These repairs could include welding, machining, fabricating/replacing damaged components, and major reconstruction of the test item. Repair up to Depot Level could be required.

Section VI
Test Discipline

5-9. General

The high-visibility and oversight of LFT requires strict discipline during the conduct of the testing. This paragraph summarizes key test discipline items which are applicable to future LFTs.

a. Follow the DTP. One of the primary responsibilities of the tester is to ensure that the test is conducted in accordance with the HQDA approved DTP. Unauthorized deviations from the DTP are not permitted. Additionally, **THE LFT WILL NOT START UNTIL THE DTP IS APPROVED.** With LFT&E scheduled near the critical full-rate production decision milestone and test shots relatively expensive, it is essential that the DTP be followed to avoid potential problems. Conducting the test according to an approved DTP will eliminate the perception of bias or of rigging the test in order to ensure positive results. Changing shotlines, threats, stowage,

etc., even for sound technical reasons, without proper coordination and authorization is not permitted.

b. Change Procedures. It is rare that a LFT is conducted without some deviation from the approved DTP being required. In order to address these potential deviations and retain testing integrity, a strict procedure has been adopted for approving changes to the DTP. This change procedure is described in Chapter 3.

c. Reporting Emerging Results. The dissemination of emerging results provides test participants a continuing awareness of test progress and an early identification of potential vulnerability/lethality shortcomings. Data is usually disseminated at data review meetings. These meetings should be held periodically throughout the test so that data can be reviewed, commented on, and necessary subjective judgments reviewed for consistency and soundness. Representatives of the damage assessment team (DAT) (see paragraph 5-10), PM, and system contractor are typically present at these meetings. However, it should be noted that for purposes of assessing the shots, the PM and system contractor have no vote, but are present to provide information on system design characteristics, if required. The OSD will have access to these meetings; however, any results addressed during these meetings and used in the OSD assessment will be provided to the Army for factual review prior to its use.

Section VII
Damage/Casualty Assessment

5-10. General
After each shot the target is examined and the system damage and crew casualties are assessed. This paragraph defines the Army approach to this process.

5-11. Damage Assessment Team (DAT)
The DAT is responsible for collecting and assessing crew incapacitation and/or test item/target damage after each shot. The DAT will be chaired by the SLAD/BVLD and will include the tester and the user as a minimum. Other interested organizations will be requested to support the DAT as required. The specific tasks of the DAT are to:

a. Document any physical damage to the simulated crew member and assess the extent of their injuries (i.e., level of incapacitation).

b. Document any physical damage to the test/target item.

c. Determine if any injury, degradation, and/or loss of function (LOF) occurred which would affect the ability of the crew and system to perform their mission.

d. Determine the damage mechanisms causing any injury, degradation, and/or LOF.

e. Characterize the test item's performance and other parameters, before and after each shot, to allow for future vulnerability reduction/lethality enhancements.

f. Document and characterize behind-armor effects produced by the test munition.

g. Utilize the preceding information to assess crew casualties and system $P_{k/h}$ values for the test munition.

h. Provide a final damage assessment report for each shot; necessary subjective judgments will be based upon the majority viewpoint of the DAT.

5-12. Crew Vulnerability

Crew vulnerability can be assessed through the examination of data collected with crew simulants and crew environment instrumentation.

a. Crew simulants can be used to assess the expected damage to the crew members. The following simulants have been used in previous LFTs:

(1) Fully combat dressed wooden mannequins placed in crew positions in the expected penetrator path/spall cone where acceleration injury is not a main concern. After each shot, the fully combat dressed mannequins are assessed for damage (e.g., burns on clothing, damaged body parts, fragment penetration/perforation, etc.).

(2) Fully combat dressed anthropomorphic simulants ("anthros") placed in crew positions where acceleration is the main concern. "Anthros" can be used to measure triaxial acceleration, compression, biaxial bending, fore-aft bending, and neck shear.

b. The crew compartment(s) can be instrumented to collect thermal, toxic fume, and blast overpressure data. The following crew environment data have been collected in previous LFTs:

(1) Temperature and heat flux levels at each crew member location. These data allow a determination of the level of burn

damage and the effectiveness of the crew member's protective uniform.

(2) Toxic fume levels at each crew member location. Data on toxic gases, pyrolysis products, and airborne particulates are collected.

(3) Blast overpressure levels at various crew locations. These data are used to determine the level of crew incapacitation due to injury to the air containing structures of the body (e.g., lungs and ears).

c. The collected simulant and environmental data are analyzed and compared to approved crew injury criteria to determine an expected level of crew incapacitation. These data are used by SLAD/BVLD in the overall crew survivability assessment.

5-13. Vehicle Vulnerability

a. After each individual shot, all damage is recorded, as well as obvious vehicle functional degradation (e.g., engine will not run). This damage assessment is then used to determine vehicle vulnerability in the form of single-shot kill estimates. These estimates are derived from the damage assessment report by the use of fault-tree or deactivation diagrams and an assessment, by the user, of the resulting LOF. Existing kill categories for armored vehicles and aircraft systems are presented below.

(1) Mobility Kill (M-kill). An armored vehicle suffers a M-kill if it becomes incapable of executing controlled movement and cannot be repaired by the crew (within approximately ten minutes) on the battlefield.

(2) Firepower Kill (F-kill). An armored vehicle suffers a F-kill if it becomes incapable of delivering accurate, controlled firepower and cannot be repaired by the crew (within approximately ten minutes) on the battlefield.

(3) Catastrophic Kill (K-kill). An armored vehicle sustains a K-kill when both a M-kill and a F-kill occur and it is not economically repairable.

(4) Attrition Kill. An attrition kill is obtained when an aircraft sustains combat damage so extensive that it is neither reasonable nor economic to repair. This category is divided into six levels of kill depending on the time after impact at which manned control is no longer achievable.

(5) Forced Landing. This kill is obtained when an

aircraft sustains combat damage that forces the crew to execute a controlled landing (powered or unpowered). This category includes aircraft which will require repairs for flight to another area and aircraft which cannot be repaired on-site but can be recovered by a special team.

(6) Mission Abort. This kill is obtained when an aircraft sustains combat damage that prevents completion of the designated mission but permits the aircraft to return to base.

(7) Mission Available. This kill is obtained when an aircraft has landed but will require repair before returning to a mission-ready status.

b. In addition to providing insights into system vulnerability, LFT&E can provide the user "hands-on" experience in BDAR. During LFT&E, BDAR can provide the user insights into the time, parts, tools, and skills required to repair the system to a combat-capable condition. Evaluation of a system's capabilities immediately following a simulated threat attack compared to the system's capabilities following crew, organizational, and direct support repair provides insights into the overall fightability of the system. Another application of the repair process is to examine the spare part supply line to ensure parts stocked are in fact those required to support damage sustained from a battlefield encounter.

Chapter 6
Lessons Learned

Section I
Introduction

6-1. General
Live Fire Testing is one of the most visible and expensive phases of developmental testing and requires detailed planning, documentation, and coordination in order to ensure an efficient and effective program. To make it affordable and efficient and to ensure that the Army is provided the best information for its investment, future LFT&E efforts must take advantage of experience gained during the development and conduct of previous LFT&E programs. Incorporation of these lessons into the planning and conduct of future LFT&E efforts will ensure that the maximum return is achieved on the Army's investment in LFT&E.

6-2. Affordable
To keep LFT&E affordable, the number of full-up shots must be kept to an absolute minimum. To minimize the number of full-up system shots, the LFT&E strategy must be structured with extensive component-level tests which collectively support resolution of critical system survivability and/or lethality issues. A successful component-level test program can minimize the number of required full-up shots and thereby reduce LFT costs. The information from a few, well-designed full-up shots can lead to system vulnerability reductions or lethality enhancements which can make a difference in the battlefield survivability of both the crew and the system.

Section II
Test Planning and Execution

Recently, the Army conducted extensive LFTs on its two primary combat vehicles - the Abrams Tank and the Bradley Fighting Vehicle. This paragraph summarizes key lessons learned from a test planning and test execution standpoint which are applicable to future vulnerability and lethality LFTs.

6-3. Management
Management of a LFT is best accomplished by a matrix organization responsible for test planning, test execution, evaluation of test results, and test documentation. That organization must have access to professionals with expertise in ballistics, vulnerability/lethality modeling, casualty and damage assessment,

developmental testing, combat vehicle repair, BDAR, and materiel systems analysis and evaluation. Figure 6-1 illustrates the matrix organization created by the Army for the conduct of the Bradley and Abrams LFTs.

6-4. Documentation
Prior to firing a round, prepare an IEP/TDP, a DTP, and obtain approval/comments from both the Army and OSD leadership. Include in the IEP/TDP and the DTP all information required by the OSD LFT&E Guidelines and ensure all testing and subsequent evaluations are conducted in strict compliance with these plans. These plans must be of sufficient detail to preclude misunderstanding by the Army and OSD leadership.

6-5. Participants
Identify all oversight organizations (e.g., OSD, General Accounting Office, etc.) and involve them both in the test design and test execution processes. Concerns by these organizations must be raised and addressed prior to or during testing - NOT after test completion.

6-6. Data Sharing
Share test data with all activities as soon as data are validated so that oversight organizations, the independent evaluator, the PM, and the user representatives have the same information at any point during the test.

6-7. Emerging Results
Establish a formalized emerging results forum where the matrix test team can identify and document potential evaluation issues. Follow-up with research by the PM and/or off-line tests and investigations by the system contractor to shed additional light on these potential issues so that they are either resolved prior to test completion or identified for inclusion in the final evaluation report. The guiding principle must be to address all vulnerability/lethality concerns in the emerging results forum as they are identified to preclude "surprises" by the contents of the final reports. The OSD will be provided access to the emerging results. However, all emerging results identified by OSD for use in supporting its independent assessment will be provided the Army for factual review prior to its use.

6-8. Evaluation
Prepare a balanced evaluation report which objectively describes both the negative and positive aspects of the results. For example, not all vulnerabilities identified in a vulnerability LFT&E can be fixed. Constraints on system funding, system weight, etc., necessitate that the matrix team participate in the prioritization of the identified vulnerabilities from the perspectives of likelihood of occurrence on the battlefield and

the degree of system degradation given an occurrence. The final evaluation report provides that information to the user and to the PM for resolution.

6-8. Evaluation
Prepare a balanced evaluation report which objectively describes both the negative and positive aspects of the results. For example, not all vulnerabilities identified in a vulnerability LFT&E can be fixed. Constraints on system funding, system weight, etc., necessitate that the matrix team participate in the prioritization of the identified vulnerabilities from the perspectives of likelihood of occurrence on the battlefield and the degree of system degradation given an occurrence. The final evaluation report provides that information to the user and to the PM for resolution.

Section III
Technical Lessons Learned

6-9. Lessons Learned
During the conduct of previous LFT&Es, lessons learned from a technical aspect were identified and are enumerated below. These technical lessons learned not only address LFT&E but also weapon system design principles which may prove useful in future development endeavors.

a. Live Fire Testing is beneficial. Extensive use of off-line testing to address such issues as sympathetic detonation, ammunition/propellant compartmentalization, and collateral damage will keep LFT&E affordable while ensuring that critical issues are adequately addressed. Preserve valuable assets to address those issues which require a full-up system to answer.

b. Identify vulnerability reduction/lethality enhancement measures early in the development process. Take advantage of the SLAD/BVLD expertise in this area. Do not wait until LFT to ensure vulnerability reduction/lethality enhancement measures are adequate. Vulnerability reduction/lethality enhancement measures must be considered during the system design process.

c. Design the system for both peacetime and wartime use. For example, the Abrams Tank was developed with an inhibitor which would not allow the driver to exceed two miles per hour if the system indicated the engine had been damaged. Obviously, this was to preserve valuable engines during peacetime training/testing operation but can significantly limit vehicle performance during combat situations. Thus, "combat overrides" to "peacetime inhibitors" should be a principal design

consideration. (NOTE: The problem cited in this example was identified during Abrams Vulnerability LFT; the PM has developed a fix which corrects this problem.)

d. Take a total systems look at crew and system vulnerability. This means one must consider the contribution of all items (crew clothing, component hardware, ammunition, fuel, and stowage items) to crew and system vulnerability. For example, design or store stowage items so that they do not pose a fire hazard to the crew.

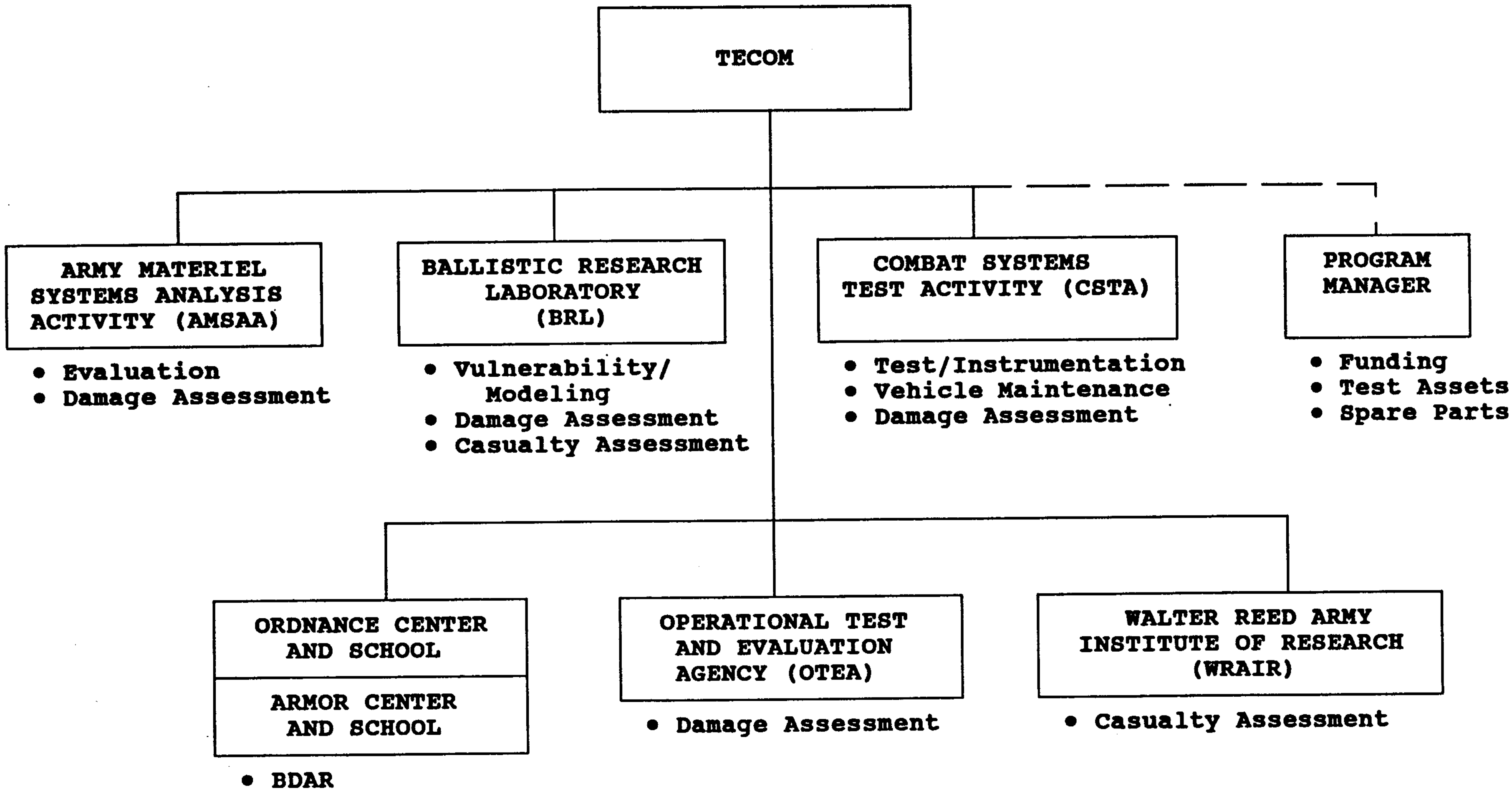


Figure 6-1. Bradley and Abrams LFT Matrix Organization

Chapter 7
Alternatives for Threat Tank and Helicopter Targets

Section I
Introduction

7-1. Source of Information
This information in this chapter is taken (almost verbatim) from two AMSAA memoranda (14 March 1989 and 19 May 1989) on the subject of Live Fire Lethality Test Target Surrogates.

Section II
Tank Targets for Live Fire Lethality Testing

7-2. General
Live Fire Lethality testing of U.S. antitank munitions shall include, when feasible, the firing of that munition against threat targets. Since it is very unlikely that future threat tank targets (requirements for antitank munitions) will be available at the time they are needed for Live Fire Lethality testing, it is necessary to identify and evaluate alternatives for threat tank targets and recommend the preferred alternative(s).

7-3. Classification Scheme
The Army DCSINT has developed a classification scheme for threat tank range target (armor arrays) data. It is also applicable to tank target (reference target) data. The categories are:

a. An original or actual specimen.

b. A duplicate or replica created from original specification.

c. A surrogate or reasonable facsimile which is created from specific knowledge about original specifications.

d. A substitute which represents some general knowledge or performance characteristics of the original.

e. A postulated technology option derived from an intelligence assessment.

7-4. Threat Tank Target Data
For Live Fire Lethality testing of antitank munitions the threat

tank target data are and will probably always be a postulated technology option derived from an intelligence assessment.

7-5. LFTE Alternatives

a. The testing and evaluation alternatives are defined (Table 7-1) in terms of the type of target fired at in Live Fire Lethality tests, whether the target functions (i.e., mobility, firepower, etc.), what the test addresses (armor perforation, damage mechanisms, components), and the basis for the overall lethality assessment (test, model).

(INSERT TABLE 7-1)

b. The eight lethality test and evaluation alternatives break logically into three groups:

(1) Functioning tanks with an overall lethality assessment based upon test results (alternatives 1-4).

(2) Ballistic hull and turret with the crew (alternative 6) or crew and components (alternative 5) represented by boxes with a limited overall lethality assessment based upon test results.

(3) Ballistic hull and turret only (alternative 7) or range targets (alternative 8) with no overall lethality assessment based upon test results.

7-6. Modeling
Regardless of the scope of lethality testing, the overall lethality assessment will be supplemented with model predictions.

7-7. Antitank Damage Mechanisms

a. Live fire and joint live fire lethality and vulnerability testing indicates that the dominant antitank damage mechanisms are the primary penetrator and spall. Lethality of antitank projectiles depends on whether the armor is perforated, the extent of spall damage (cone angle and amount of spall), the location of major vulnerable components (crew, ammo, fuel, etc.), and the specific way the tank design is implemented (e.g., do subsystems fail gracefully, location and distribution of hydraulic and electrical power lines, are there redundant systems).

b. Spall damage varies as a function of the type of armor perforated (e.g., laminate ceramic versus reactive) because the

penetrator is attacked differently by the different armor defeat mechanisms. A penetrator could have the same degree of overmatch against two different armor technologies and have different spall characteristics.

c. In addition, the target structure and way the armor is integrated into the vehicle structure will affect collateral damage to components (e.g., damage due to ballistic shock) and affect multi hit performance of the vehicle. Technical projections of future tanks address armor and gross characteristics. However, the details on the components and vehicle design cannot be adequately projected.

7-8. Target Alternatives

a. Functioning tank alternatives are appealing because lethality can be assessed directly for each shot fired. The practical limits on numbers of shots fired dictates that an overall lethality assessment be based upon both test results and calculations for a broader spectrum of conditions. Ideally, the testing should confirm that the model predictions are accurate or provide the basis for modifying the model to permit an accurate set of predictions.

b. Alternatives 1 and 2 have the highest level of perceived fidelity because the armor and the configuration are matching or trying to match the threat projections. Actual fidelity will probably be considerably less than perceived fidelity because there is little or no information on which to project component characteristics and vehicle design. It is very unlikely that the component vulnerability or the system loss of function for these targets will match the future threat.

c. In addition, the configuration projections for the future threat tanks are radically different than any available U.S. or older threat systems, and it is unlikely that these kinds of modifications could be made in a configuration with acceptable functioning or vulnerability characteristics. Therefore, neither alternatives 1 or 2 are recommended.

d. Armor on U.S. or available older threat tanks can be modified to represent a level of overmatch (residual penetrating capability) or can be replaced with a range target that represents the threat armor projections. Both options have potentially significant limitations. Modifying the armor to represent a level of overmatch probably would not represent spall accurately. Replacing the armor with a range target may alter significantly the collateral damage to components and, therefore,

may give a misleading impression of system loss of function. Given these limitations and since the configurations of future threat tanks are significantly different than the U.S. or older available threat tanks, alternative 3 is not recommended.

e. Alternative 4 (U.S. or older threat tank without modifications) is not recommended because it does not match threat projections for armor, components, or configuration. However, firing against a U.S. or older available threat tank without modification can provide some useful supplemental insight into the overall lethality assessment against tank targets. In addition, it adds to the vulnerability data base on these tanks.

f. Ballistic hull and turret (BHT) alternatives 5-7 built to threat armor projections can provide an accurate representation of the areas that can be perforated and the degree of behind-armor effects for areas perforated. If components (mannequins and boxes that represent components occupy the projected areas) are included then a limited lethality assessment for shots fired based directly upon tests can be made. Alternative 5 is the most comprehensive of these alternatives, but it is not sufficient because the target does not function.

g. Alternative 8 is not recommended because it does not provide even a limited basis for assessing lethality against the threat tank for the shots fired directly from the test. In addition, firings against range targets have always been part of the standard development tests that contribute to the overall lethality assessment.

7-9. Alternative Selection

None of the alternatives by themselves is adequate for live fire lethality testing; however, it is possible to fire against three different targets to adequately demonstrate lethality in live fire tests. The three different targets and the type of tests recommended are as follows:

a. Threat tank range target tests with sufficient sample sizes to establish with high statistical confidence that the ability of the baseline and developmental anti-armor munition to perforate the range targets of interest and to characterize the behind-armor spall characteristics of both munitions.

b. Ballistic hull and turret targets constructed to threat armor projections and configured with crew and major component box representations to demonstrate major lethality differences between baseline and developmental anti-armor munitions.

c. U.S. or older threat tank (without modifications) to provide a limited demonstration of lethality of the baseline and developmental munitions against a functioning vehicle. (Note these tests may not demonstrate significant differences because both munitions may significantly overmatch these targets.)

Section III
Helicopter Targets for Live Fire Lethality Testing

7-10. General
Live fire testing of U.S. anti-helicopter munitions shall include, when feasible, the firing of that munition against threat targets. Since it is very unlikely that future threat helicopter targets (requirements for antihelicopter munitions) will be available at the time they are needed for Live Fire Lethality testing, it is necessary to identify and evaluate alternatives for threat helicopter targets and recommend the preferred alternatives. Thus, for Live Fire Lethality testing of antihelicopter munitions the threat helicopter target data are and will probably largely be postulated technologies and configurations derived from intelligence assessments.

7-11. Munitions-Target Interactions
Our antihelicopter munitions will be largely smart munitions in that they will respond to target signatures to execute terminal maneuvers (optimizing accuracy and approach angles) or optimize fuzing/detonation points relative to the target by sensing target proximity. These complex interactions of our antihelicopter munitions with a variety of signatures, countermeasures (false signatures or obscuration/suppression of signatures), and environmental conditions will require substantive laboratory, technical, and operational testing preceding any Live Fire testing so that Live Fire testers have sufficient basis to define shots about meaningful intercept conditions.

7-12. Aircraft Damage Mechanisms

a. Lethality and vulnerability testing indicates that the dominant damage mechanisms against aircraft (including helicopters) are the warhead fragments and blast. The blast effect are significantly enhanced by warhead penetration of the aircraft skin. Munitions optimized for fragment kills use various forms or fuzing to detonate the warhead when in proximity of the threat aircraft. Munitions which depend on the blast kill mechanism may optimize their point of impact based on target signature to take advantage of vulnerability features of the

aircraft. Hit-to-kill missiles can achieve bonus effects by the missile body continuing to fly into the aircraft target.

b. There are also dual purpose munitions which are designed for both anti-armor and anti-aircraft roles. Typically these munitions have a point detonating shaped charge warhead matched to the armor threat of interest and for the air defense role a proximity fuze which senses if the munition is about to miss the target and detonates the warhead to generate lethal fragmentation. The shaped charge warhead effect is often so overmatched to the aircraft target that a direct hit is a virtual kill.

7-13. Target Alternatives
Live fire testing and evaluation alternatives are defined (Table 7-2) in terms of the type of target fired at in Live Fire Lethality tests, whether the target is functional or flyable, what the test addresses, and the basis for the overall lethality assessment (test, model, or a combination of both).

(INSERT TABLE 7-2)

a. Alternatives 1 and 2 are certainly the most credible alternatives for addressing live fire objectives. The acquisition of actual threat targets in quantity for exploitation (Alternative 1) in live fire will not likely include the latest threat systems. It may be possible to acquire limited numbers of threat helicopters which have been fielded in quantity and exported widely. Also, commercial versions of some helicopter types may be available on the world market as the Soviets or others seek opportunities to gain hard currency.

b. The construction of flyable surrogates based on technical threat projections (Alternative 2) is a very costly and risky approach to satisfying live fire target requirements. Development costs would be similar to the development of any new helicopter and the uncertainty of projections carries with it the risk of developing exactly the wrong surrogate. However, the development of non-flying/non-functioning surrogate targets based on threat projections is probably very reasonable. This approach might also allow the exploration of projected design alternatives at reasonable costs.

c. The use of modified US or older threat aircraft (Alternative 3) provides the most reasonable alternative for conducting Live Fire Tests of fully functioning helicopters. Use of helicopters which most closely conform to the projected threat design can assist in understanding the influence of dynamic

effects on munitions lethality.

d. Finally, the construction of a fuselage shell, major component boxes and mannequins (Alternative 4) based on technical threat projections, although significantly lacking in resolution, may be the solution to maximizing the utility of a limited number of more faithful but expensive target alternatives. This alternative should allow the exploration of expected effects through numerous live fire shots and permit "tuning" of our models to minimize the number of shots required against the more expensive and scarce alternatives.

7-14. Alternative Categories

The lethality test and evaluation target alternatives break logically into four categories. None of these categories offer an entirely satisfactory technical solution and the costs associated with flying and functioning targets are very high. The categories for each alternative are:

a. Flyable-functioning helicopters with an overall lethality assessment primarily based upon observation of test results (collection of damage effects data frequently not possible).

b. Non-flyable/functioning helicopter targets (typically tower mounted) with an overall lethality assessment based upon a combination of modelling (principally to define intercept and fuzing/detonation points) and test results (collection of damage effects data).

c. Non-flyable/nonfunctioning helicopter targets (typically tower mounted) with an overall lethality assessment based upon a combination of modelling (defining intercept/fuzing and damage effects on nonfunctioning components) and test results (collection of damage effects data).

d. Fuselage or major subsystems representative of comparable threat helicopter components (i.e., engine, rotor system, etc.), with an overall lethality assessment based principally upon modelling.

7-15. Category Selection

a. The most realistic category for live fire lethality against threat helicopters would appear to be against the flying helicopter targets (drone kits installed and flown by a remote flight qualified operator). However, using flying targets alone is not a totally acceptable solution with regard to data collection.

b. A lethal engagement of a flying drone threat helicopter or surrogate will most often result in a crash which causes other damage tending to mask damage effects created by the weapon fired at the aircraft. True lethality might also be masked by "lethal" damage to the drone control system resulting in a helicopter target crash.

c. Diagnosis of which effects are munition related or crash related in determining lethality for live fire is costly and time consuming, and often not possible. Under these conditions, refurbishment of targets may frequently be out of the question.

d. This target category may require nearly one target per engagement fired for live fire lethality (at possible millions of dollars per copy depending upon the fidelity of representing the threat).

e. The next most realistic category for live fire lethality testing would be against non-flying/functioning alternatives. Helicopters can be tied down on a tower and simulate a hovering or slow flying helicopter by running engines, rotor blades, and other subsystems to create conditions for obtaining fairly realistic lethality effects given that intercept and fuzing geometries are well understood.

f. Although damage effects can be acquired from functioning tower mounted targets, the true test of whether or not the helicopter would have crashed from some damage effects in dynamic flight may only be derived with absolute certainty by using a flying helicopter. For example, rotor blades hit while rotating on a tethered machine are subject to different dynamic loads than rotor blades on a real hovering helicopter and the effects on controlled flight may not be readily apparent in the tethered case.

g. Functioning (flying or non-flying) helicopter alternatives are most appealing because nearly the entire range of damage effects may be assessed for each shot.

h. The non-flying/non-functioning category of threat target is a less realistic category for each alternative, but is probably one of the more practical and among the most affordable of the categories for each alternative. However, without engines running and rotor blades rotating, the realism of live fire lethality will be limited for some munition effects.

i. The least realistic category for each alternative is the use of the fuselage and/or major components for live fire

testing. However, from a practical point of view the fuselage and component shots are an essential building block to gaining enough information to tune lethality modelling and decide on the nature of "full up" shots against more realistic target alternatives.

7-16. LFTE Approach

a. The major thesis to be derived from the preceding discussion is to proceed on a building block approach from the crudest representation of threat targets to build a vulnerability/lethality data base and to minimize the use of scarce and costly threat target resources in the live fire program. It is probably not reasonable to expect a cookbook solution for all types of munitions.

b. The preceding discussion may offer a hierarchy of solutions where we might enter the Table 1 matrix at the component level in developing basic vulnerability assessments and then developing our live fire lethality data using helicopter targets which provide acceptable levels of realism and affordability.

c. A combination of Alternatives 2c/d (non-flyable/non-functioning and fuselage-major subsystem surrogates) and 3a/b (flyable-functioning and non-flyable/functioning older US or threat surrogates) is probably the most practical and affordable approach for building a realistic matrix of live fire lethality tests against threat helicopters.

TABLE 7-1. TANK LFT&E ALTERNATIVES

		Target	Whether Armor is Target	Mechanisms		Target Component Vulnerability		Overall Lethality Assessment	
Other	Alternative Crew	Other	Test	Pen/ Model	All	Functions	All	Perforated	Spall
1	Prototype built based upon tech projections	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Modified U.S. or older threat tank: armor and components	Yes	Yes	Yes	Yes	Yes[b]	Limited	Yes	Yes
3	Modified U.S. or older threat tank: armor only	Yes	Yes	Yes	Yes	Yes[b]	No	Yes	Yes
4	U.S. or older threat tank without any modification	Yes	Yes	Yes	Yes	Yes[b]	No	Yes	Yes
5	BHT[a] with mannequins and major component boxes	No	Yes	Yes	No	Yes[b]	Limited	Limited	Yes
6	BHT[a] with mannequins only	No	Yes	Yes	No	Yes	No	Limited	Yes
7	BHT[a] (armor shell only)	No	Yes	Yes	No	No	No	No	Yes
8	Range targets	No	Yes	Yes	No	No	No	No	Yes

[a]Ballistic hull and turret built to threat projections

[b]Accuracy depends on the extent to which the crew locations and shielding by components represents the threat projection

TABLE 7-2. HELICOPTER LFT&E ALTERNATIVES

Lethality Assessment Alt Fuel Fire	Target: Engine	Target	Target: Other	Target Flying/Tower: Test	Target Flying/Tower: Model	Damage Mechanisms	All: Signature	Target Component Vulnerability	Blast	Frag	All: Other	Overall: Crew
1 Actual target exploitation												
a Flying-Functioning	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	-
b Non-Flyable/Functioning	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
c Non-Flyable/Non-Functioning	No	Yes	No	Yes	Yes	No	Yes	Part	No	No	-	Yes
d Fuselage/Components	No	No	No	Part	Part	No	Yes	No	No	No	-	Yes
2 Prototype built based on technical projection												
a Flying-Functioning	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	-
b Non-Flyable/Functioning	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
c Non-Flyable/Non-Functioning	No	Yes	No	Yes	Yes	No	Yes	Part	No	No	-	Yes
d Fuselage/Components	No	No	No	Part	Part	No	Yes	No	No	No	-	Yes
3 Modified U.S. or older threat aircraft												
a Flying-Functioning	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	-
b Non-Flyable/Functioning	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
c Non-Flyable/Non-Functioning	No	Yes	No	Yes	Yes	No	Yes	Part	No	No	-	Yes
d Fuselage/Components	No	No	No	Part	Part	No	Yes	No	No	No	-	Yes
4 Fuselage constructed with major component boxes and mannequins	N/A	N/A	N/A	Part	Part	No	Yes	No	No	No	No	Yes

DEPARTMENT OF THE ARMY PAMPHLET 73-1

TEST AND EVALUATION GUIDELINES

PART SEVEN

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Chapter 1 Army Software Test and Evaluation

Section I
Introduction

1-1. Scope
This material contained herein applies to all Army software T&E performed for systems developed and/or maintained in accordance with (IAW) AR 70, Materiel System Computer Resources (MSCR), and AR 25, Automated Information Systems (AIS), series of regulations. This includes T&E in relation to development and support of the software element of firmware. It provides both DOD-STD-2167A and DOD-STD-7935A documentation profiles.

1-2. Objectives
This part of DA Pamphlet 73-1:

a. Describes a unified software test and evaluation process for MSCR and AIS.

b. Describes the implementation procedures for AR 73-1 policies related to software T&E.

c. Describes a disciplined approach to life cycle software T&E.

d. Describes the Army standard for planning and implementing software test and evaluation. This will promote:

(1) Consistency and ease of application.

(2) Early involvement of the T&E community in the acquisition process.

(3) Demonstration of software capabilities.

(4) Acquisition process improvements.

Section II
Policy Basis of Software Test and Evaluation

1-3. General
Army software test and evaluation processes and practices have evolved over the years, responding to new technologies, resource constraints, organization changes, and lessons learned. These processes and practices require all Army systems involving software, whether MSCR or AIS, to undergo continuous product evaluation throughout the life cycle. DOD policies for AIS are described in DOD series 5000 and 7920, and DOD policies for MSCR are described in DOD series 5000. DOD policy provides the basis for Army T&E policy and procedures. The procurement cycle milestones (MS) and life cycle phases described in this part of DA Pamphlet 73-1 are summarized in Figure 1-1.

1-4. Department of Defense Directive (DODD) 5000.1
DODD 5000.1, "Defense Acquisition", mandates an integrated framework for translating broadly-stated mission needs into stable, affordable acquisition

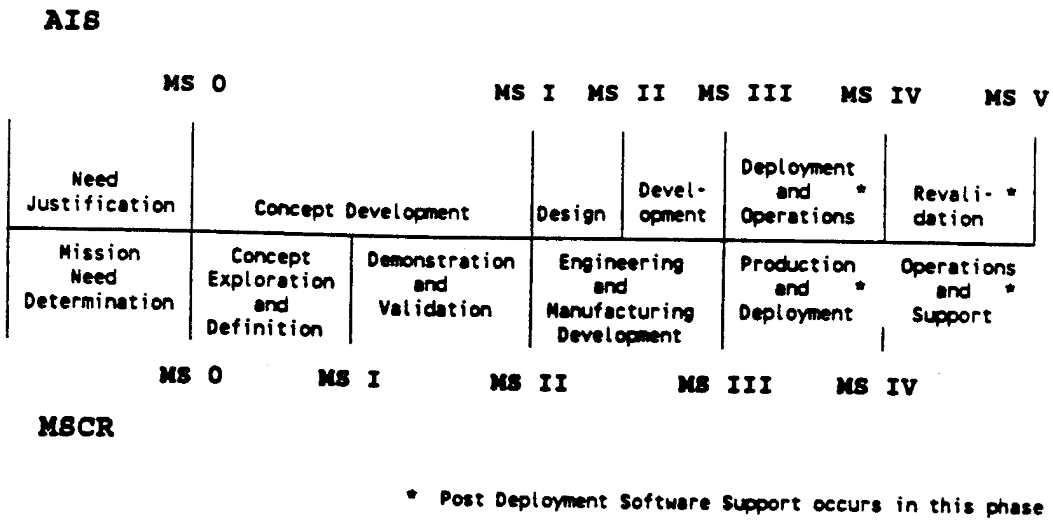

Figure 1-1. Decision Milestones and Life Cycle Phases

programs that meet the user's needs and can be sustained given projected resources. It also calls for a rigorous, event-oriented management process for acquiring quality products that emphasize effective acquisition planning and improved communications with the users. Milestones and decision events are identified. Test and evaluation shall be used to determine system maturity and identify areas of technical risk. Further, the directive indicates that performance objectives must satisfy identified operational needs and be verifiable by testing. Performance objectives include critical supportability factors such as reliability, availability, and maintainability. DODD 5000.1 also mandates independent operational test activities.

1-5. Department of Defense Instruction (DODI) 5000.2
DODI 5000.2, "Defense Acquisition Management Policies and Procedures" and its accompanying manuals, provide the implementation for DODD 5000.1. Software and system T&E must address:

a. Verifying achievement of technical performance specifications and objectives.

b. Establishing exit criteria for results that must be attained. These can be viewed as gates through which programs must pass during each phase.

c. Ensuring systems are operationally effective and suitable.

d. Providing essential information to support decision-making.

e. Designing test objectives to demonstrate capabilities appropriate to phase and milestone.
f. Utilizing early operational assessments and early prototype testing.
g. Utilizing early test planning.
h. Preparing test and evaluation master plans (TEMPs.)
i. Obtaining formal developer certification of readiness for operational testing.
j. Restricting system contractor participation in operational T&E supporting a Milestone III production decision.
k. Managing computer resources development as an integral part of system development.
l. Ensuring software maintainability is an issue during development.
m. Utilizing a disciplined software development process based on effective engineering approaches.
n. Utilizing Ada as the only programming language for new defense systems and major upgrades of existing systems.
o. Ensuring software management indicators and metrics will be used in management of software effort.
p. Ensuring software engineering practices include:
(1) Rigorous configuration control and quality assurance as required by DOD-STD-2168.
(2) Walk-throughs, inspections, or reviews of requirements documents, design, and code.
(3) Formal definition and deployment of quality control procedures and milestone quality criteria.
(4) Software security and virus protection.
(5) Independent verification and validation.
(6) Rigorous testing of modules and interfaces at all levels of aggregation.
q. Emphasizing analysis of software errors by contractor/developer to give insight into reliability, quality, safety, cost and schedule problems.
r. Utilizing prototyping and models from Milestone 0 to Milestone II to establish and refine requirements. Use of prototyping between Milestone II and III is permitted if areas are particularly high risk.

1-6. Department of Defense Directive (DODD) 7920.1
DODD 7920.1, "Life Cycle Management of Automated Information Systems (AISs)," mandates the life cycle phases and milestones for AIS systems.

1-7. Department of Defense Instruction (DODI) 7920.2
DODI 7920.2 and its associated manuals provide procedures for implementing DODD 7920.1. It mandates a process of AIS life cycle phases and associated products which encompass:
(1) Identification of needs
(2) Concept development

(3) Test and evaluation planning
(4) Preparation of TEMPs
(5) Auditing and design reviews
(6) Configuration control
(7) Tracing technical specifications to mission need and prioritized functional requirements
(8) Quality assurance plans
(9) System integration plans
(10) Software and database testing
(11) Malfunction correction
(12) Operational testing
(13) Effectiveness and suitability of training
(14) Logistics support
(15) Continuity of operations
(16) Post-deployment activities and assessments.

1-8. AR 70-1 "Systems Acquisition Policy and Procedures"
AR 70-1 covers Army policies and procedures for materiel system acquisition programs and implements DODD 5000.1 and DODI 5000.2. It describes policies for MSCR development, documentation, and support. It also establishes life cycle software engineering centers for software engineering support through development and during post-deployment software support (PDSS). The regulation requires new mission-critical software to be acquired and supported IAW DOD-STD-2167A, DOD-STD-[illegible] and DOD-STD-1467. It establishes the computer resources working group (CRWG) and the computer resources management plan (CRMP) for all AR 70 systems.

1-9. AR 73-1 "Test and Evaluation Policy"
AR 73-1 covers policies for the Army's test and evaluation program. It applies to all systems under the auspices of 70-series and 25-series regulations. It defines the role of the Army Test and Evaluation Committee, implements the Army's continuous evaluation program, defines the role of the independent evaluators, and includes policies for the TEMP.

1-10. AR 25-3 "Army Life Cycle Management of Information Systems"
AR 25-3 prescribes policies and responsibilities for the life cycle management of information systems (ISs) as described in AR 25-1. It implements Office of Management and Budget (OMB) Circular A-109, DODD 7920.1, DODI 7920.2 and DODI 7920.4. It covers need justification, concept development, design, development, acquisition, test, evaluation, deployment, operation, maintenance, and termination of life cycle management activities.

Section III
Continuous Evaluation

1-11. Background
Continuous evaluation (CE) is fundamental to the proper management of a system. Decision-making must be based upon substantive evaluations of software characteristics, and maturity and reliability indicators throughout the life cycle. These evaluations are paramount to producing quality software which meets the user's needs. Failure to perform objective evaluations throughout the life cycle has resulted in significant software deficiencies, system delays, and cost overruns.

1-12. Definition
Per AR 73-1, "Continuous evaluation is a process which provides a continuous flow of T&E information on system status and will be employed on all acquisition programs." Through analysis of available data, CE assesses technical and operational performance, functionality, effectiveness, suitability, maintainability, supportability, and identifies risks. Software CE is performed by software engineering personnel, software quality assurance (SQA) personnel, independent verification and validation (IV&V) personnel, and developers, as well as Government developmental and operational evaluation personnel.

1-13. Objective
The objective of software CE is to provide assessments of software and system progress. It is a form of risk analysis.

1-14. Scope
CE begins during the mission need determination and concept exploration/definition phases and continues through post-deployment support to system retirement. CE activities are tailored to the scope and cost of development or post deployment support activities.

1-15. CE activities and levels of evaluation
a. CE activities are conducted at three levels:
(1) CE activities performed by individuals in the development organization. The goal is to directly assess and impact quality through development activities. The results of these evaluations are reported within these organizations to document, correct, and re-examine deficiencies. Development organizations are those contractors or Government agencies tasked to perform software development or maintenance for a system.
(2) CE activities performed by individuals associated with the project/program/product manager

(PM) such as SQA and other matrix support personnel. The goal is to assess software and system quality, conformance to specifications, maturity, reliability, and stability. Evaluations performed within the matrix support organizations are reported to the PM, the developer, and independent testers and evaluators.

(3) CE activities performed by Government developmental and operational evaluators/assessors IAW AR 73-1. The goal is to formally assess software and system acceptability with respect to operational effectiveness and suitability for deployment and use. Independent evaluators report results to the acquisition community (e.g., PM, program executive officers (PEOs)) and decision-makers (e.g., Major Automated Information Systems Review Council (MAISRC)).

b. CE uses all available data sources and relies on the sharing of that data. It is imperative that the results of all evaluations be shared among the various participating communities to prevent duplication, ensure deficiencies are identified, and corrective actions are effective. CE consists of activities such as:

(1) Collecting and analyzing data on the software engineering processes and procedures (e.g., requirements analysis, requirements walk-through and reviews, design procedures, quality control procedures, formal reviews and audits, and testing). This analysis identifies processes and procedures which permit poor quality products to be developed. These processes and procedures can then be modified or replaced.

(2) Collecting and analyzing data on the software products and the results of events (e.g., system/subsystem specifications, system design reviews, code inspections). This analysis provides indicators of the software/system progress and health (i.e., quality, reliability, stability, and maintainability).

(3) Collecting and analyzing data on corrective actions to ensure proper resolution.

c. The level of evaluation required for each system throughout its life cycle is determined by the acquisition category, the cost and type of dollars expended (i.e., operations and maintenance, Army (OMA), other procurement, Army (OPA), research, development, test and evaluation (RDTE)), and oversight interest.

d. All systems must be evaluated/assessed and the results reported IAW specified criteria. System acquisition categories and classes are described in Table 1-1. Systems requiring independent evaluation are listed in Table 1-2. Acronyms used in these tables that have not been defined as yet are identified below. They are addressed in detail later in this part of DA Pamphlet 73-1.

Table 1-1. System Categories and Classes

MSCR			AIS	
Category Criteria	**Designation Authority**	**MS Decision Authority**	**Class Criteria**	**Decision Authority**
MAJOR: Designated as ACAT I or estimated to require RDT&E of > $200M or procurement of > $1B*	Under Sec. of Defense (Acquisition)	ACAT 1D- Under Sec. of Defense (Acquisition)	**MAJOR:** Class I RDT&E > $200M OPA > $1B	DAB Review
	ACAT [illegible] Under [illegible] ACAT [illegible] Component Head	ACAT 1C- DOD Component Head or DOD Component Acquisition Executive	Class II Total program cost > $100M 1 year program cost > $25M	DOD and Army MAISRC
Designated as ACAT II or estimated to require RDT&E of > $75M or procurement of > $300M*	DOD Component Head or DOD Component Acquisition Executive	DOD Component Head or DOD Component Acquisition Executive	Class III Total program cost > $50M but < $100M 1 year program cost > $15M	HQDA and Army MAISRC
			Class IV Total program cost > $10M but < $50M	HQDA and Army MAISRC
NON MAJOR: Designated as ACAT III	DOD Component Acquisition Executive	Lowest level deemed appropriate by designation authority	Class V Total program cost > $2.5M but < $10M	HQDA and MACOM MAISRC
Designated as ACAT IV	DOD Component Acquisition Executive	Lowest level deemed appropriate by designation authority	**NON MAJOR:** Class VI Total program cost < $2.5M	MACOM

* FY80 constant dollars

(1) DAB - Defense Acquisition Board
(2) DISC4 - Director of Information Systems Command, Control, Communications, and Computers
(3) HQDA - Headquarters, Department of the Army
(4) MACOM - Major Command

Table 1-2. Systems Requiring Independent Test and Evaluation

Major Systems	Independent Evaluation Govt. Developmental	Operational
Acquisition Category (ACAT) I, II, (MSCR)	Independent Evaluation Report (IER)	Operational Assessment (OA) Early OA (EOA) TER
Class I, II, III, IV, V* (AIS)	IER	OA/EOA/TER
Non-Major Systems		
ACAT III, IV (MSCR)	Independent Assessment Report (IAR)	Abbreviated Operational Assessment (AOA)
Class V* (AIS)	IAR	AOA
Class V*, VI (AIS)	No requirement for independent evaluation (Requires test plans, test cases/procedures, test reports and evaluation by the tester.)	

* Option for independent evaluation is determined by DISC4

Section IV Independence in Software Test and Evaluation

1-16. Application

Independence in testing and reporting channels promotes objectivity in test and evaluation activities. Army requirements for independent testing are cited in AR 73-1. There are three basic levels of independence.

a. Independence within the development organization includes quality assurance (QA) and test personnel who report through a different chain of management than the software designers and coders.

b. Independence within the PM matrix organizations includes quality, IV&V, and test personnel who provide evaluation or testing for the PM, but report through

the major subordinate command (MSC) or major command (MACOM) rather than the PM's chain of command.

c. Independent developmental and operational testers and evaluators. Examples include personnel from Test and Evaluation Command (TECOM), Operational Evaluation Command (OEC), Army Materiel Systems Analysis Activity (AMSAA), Test and Experimentation Command (TEXCOM), Combat Systems Test Activity (CSTA), Logistics Evaluation Agency (LEA), Corps of Engineers (COE), Intelligence and Security Command (INSCOM), Health Services Command (HSC) and Information Systems Engineering Command (ISEC). These personnel report findings to Department of the Army (DA) decision-authorities.

Section V
Software versus System Testing

1-17. General

a. Unifying the T&E process requires that the software T&E mission include not only software, but its capability to perform as an integral part of the target system in support of operational mission requirements. There are two objectives to testing: demonstration of performance and fault removal.

b. Software T&E must address system-level requirements which include, but are not limited to, performance, training, interoperability and interfaces with other systems, supportability, continuity of operations, and user interfaces. These aspects of the total system are part of the T&E mission and must be tested and evaluated with the software functions. Specialized system tests which are part of the software integration process include:

(1) Peak load test, e.g., all terminals active.

(2) Storage testing, e.g., verify capacity of the system to store a specified amount of transaction data on a disk or in other files.

(3) Performance time testing, e.g., response time for inquiry when system is fully loaded with transaction data.

(4) Recovery testing, e.g., load backup copy of data and resume processing after failure, without data or integrity loss.

(5) Procedure testing, e.g., determine clarity of documentation on operation and use of system by having users do exactly what the manuals request.

(6) Human factors testing, e.g., determine how users will use the system when processing data or preparing reports (i.e., finding out how users will react to the system in ways not anticipated by the analyst(s)).

c. An incremental test strategy allows a variety of test types which are diverse enough to provide

confidence in the effectiveness of the test process. In addition, an incremental strategy provides a means to identify and correct failures earlier and more efficiently. Figure 1-2 shows the relationship between different levels of requirements and corresponding test levels.

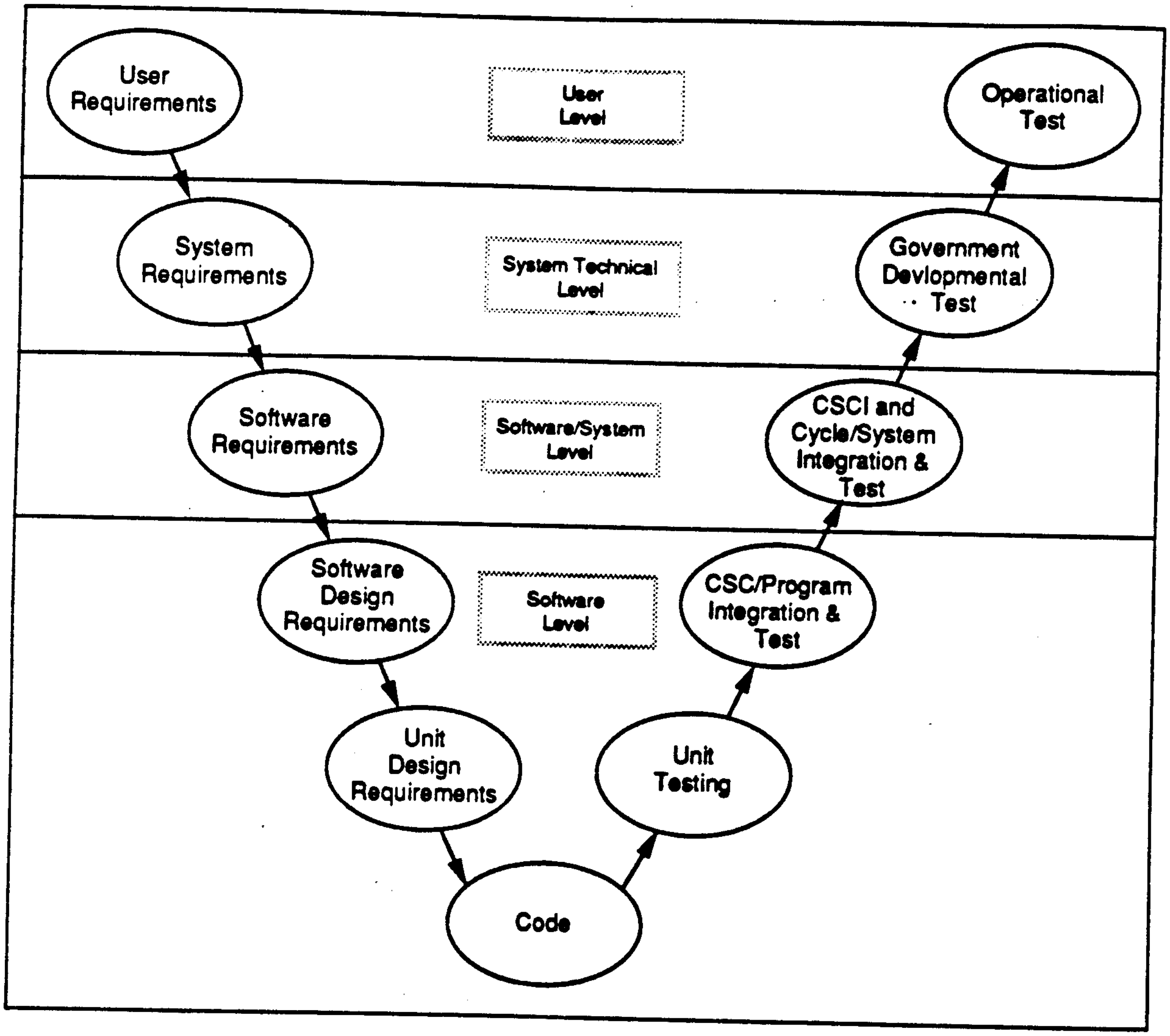

Figure 1-2. Requirements and Test Level Relationship

1-18. Test levels

a. Software tests. Lower levels of software tests performed by the software developers/engineers are structured to verify the accuracy of algorithms and computations, and to make sure that the portions of coded software work IAW the design, meet the expected

results, can handle erroneous inputs and have been exercised with combinations of differing functions. Software engineers/developers are responsible for ensuring that user requirements are correctly implemented in their designs and that, when pieces of software are integrated, they function as required.

b. Software/system tests. As the software subsystems are integrated, software developers/ engineers ensure that realistic stress and interoperability are verified in tests at systems integration. This is the final opportunity to check software requirements prior to technical tests run by the Government at the system level. Software tests during development and after Milestone III are normally conducted in software development facilities and laboratories.

c. System technical tests. Technical system-level tests look at the capability of the software to support system performance. Government-run technical tests, called developmental tests (DTs) are conducted in the laboratory, Government testbeds, and/or user environments using qualified civilian/soldier personnel. Government developmental testing is structured to subject the system to stress levels commensurate with those that the mature system will be subjected to in representative operating environments. These tests may be structured to estimate the outer limit of the system's operational envelope, if required. Engineering requirements, performance, and user requirements are also examined during DT. Government developmental testing is also conducted on upgrades and fixes after Milestone III.

d. Operational tests. Operational testing is system-level testing which focuses on effectiveness and suitability. Characteristically, operational tests involve the intended user troop units or organizations, and take place in realistic operational environments. Operational tests may be performed at any time during the life cycle. An initial operational test (IOT) is <u>required</u> for the Milestone III decision to produce/deploy and field a system. Other forms of operational testing may be used to assist in refining user requirements, to develop standing operating procedures (SOPs), to identify new or different means to employ the system, etc. Examples of operational tests IAW AR 73-1 include early user test (EUT), early user experimentation (EUE), limited user test (LUT), force development test (FDT), concept evaluation program test (CEPT), or force development experiment (FDE). The need for these tests is determined by the user representatives, PM, operational evaluator, and the acquisition strategy. Following system deployment, operational tests are called on-site user tests (OSUT), or follow-on operational tests (FOTs).

Chapter 2
Terms and Definitions

2-1. Introduction

Key to implementing the software T&E process is the use of consistent and common terminology. This chapter establishes the set of terms used throughout this part of DA Pamphlet 73-1 and references similar terms currently used within the AIS and MSCR environments. Acronyms and definitions for many of the terms are contained in the Glossary.

2-2. Terminology cross-reference

Entries under the heading "Current Terms" in the following tables describe the T&E process in this part of DA Pamhlet 73-1. Other terms shown are for reference only.

a. This part of DA Pamphlet 73-1 uses a common set of terms to provide a singular approach to describing tests across the Army. Table 2-1 lists the current terms and those which have been used in the past.

b. Organizational roles are presented in Table 2-2 to show the relationship between terms currently in use and any deviations in terms used in this part of DA Pamphlet 73-1. As the Army moves T&E to the AR 70 series from the AR 25 series of regulations, additional commonality may be achieved.

c. Because MSCR and AIS developments chose to use a variety of formats for their technical data, two sets of software document classes are shown throughout this part of DA Pamphlet 73-1. Table 2-3 shows MSCR software documents related to DOD-STD-2167A and MIL-STD-490A, and AIS documents based on DOD-STD-7935A. Table 2-3 also includes documents pertaining to Government DT, independent developmental evaluation, operational test, and independent operational evaluation. Two of the documents have expanded their software role as a result of AR 73-1. They are the user functional description (UFD) and metrics reports.

d. Table 2-4 is a cross-reference of AIS and MSCR terms related to software development. Because there is much similarity between the terms, few changes have been made in the Current Term column.

e. The categories and priorities presented in Table 2-5 provide a standard means to score software deficiencies during development and test. These common classifications form the basis for controlling entry and exit objectives, promoting standard interpretation of test deficiencies and fostering meaningful entries in the Army Test Incident Report System (ATIRS).

f. Table 2-6 shows software and system-level T&E events and the organizations responsible for those events. Primary responsibilities, events, and overall

chronology are depicted. Other groups participate throughout the life cycle to ensure T&E involvement, user involvement and sharing of data.

g. Acronyms used in these tables are discussed in detail in later chapters.

Table 2-1. Test Terminology Cross-Reference

Current Term	AIS Term	MSCR Term	Attributes
Developmental Tests: **Software Development Tests**			
Formal:			
System integration	SDT cycle/ system	System integration test (SIT)	Test witnessed by Government for software acceptance, normally CSCI (FQT) or SDT cycle/system) Software metrics collected Test plans, procedures, conditions prepared by developers/contractors Levels of test, documents defined by SOW, contract
CSCI/cycle tests	SDT cycle/ system	CSCI (FQT) tests	
Informal:			
CSC or module/ program	[illegible] module/program	CSC integration	Controlled and performed by software and system developer Lower levels of test are informal but documented in program folders or SDFs Lower levels of test run by software engineers/developers
CSU or unit tests	SDT unit tests	CSU	
Experimental	Prototyping	Prototyping/ emulation/ brassboard	Includes demonstrations or limited functional capability for users to interact with during development or design
Government DT			
Qualification tests (see AR 73-1 for test types)	SQT	DT, PPQT, FAT, CPT, TFT (depends on objectives)	Independent testers Independent evaluators/assessors Requires complete design limit tests (stress, volume) System level tests Required throughout life cycle Independent evaluation/assessment after MS III - only if new or unresolved issues

Table 2-1. Test Terminology Cross-Reference (Cont'd.)

Current Term	AIS Term	MSCR Term	Attributes
<u>User Tests (UT)</u>			
Formal Tests IOT (with SST if necessary for MS III)	SAT(SST)	OT/IOT/MOT/JT	Independent testers Independent evaluators/assessors Supplemental site tests (SSTs) used to exercise all configurations used operationally Class VI AIS systems - require IOT/FOT but no independent evaluation/assessment; tester performs evaluation/assessment
FOT/OSUT after MS III	SAT(SST)	FOT OSUT	Independent testers Independent evaluators/assessors only if unanswered issues, new issues, fixes from IOT SSTs required to exercise all operational configurations All systems with upgrades, fixes, enhancements after MS III
LUT	None	None	Generally single issue user test between MS II & MS III
EUTE (EUT, EUE)	Beta testing Prototype testing (informal)	EUTE	To answer issues prior to MS II or identify system solutions and/or define issues at MS II or beyond
FDTE (FDT, FDE)	Beta testing Prototype testing (informal)	FDTE	Conducted with users under field conditions Supports acquisition and development of req'ts, doctrine, training Can be used throughout life cycle
Emergency Fixes	Lead site verification test	Tests for emergency software fixes	

Table 2-2. Organizational Roles Cross-Reference

AIS TERM	MSCR TERM	CURRENT TERM
	Defense Acquisition Board (DAB)	No change
	MDAP, ADAP	Acquisition Category (ACAT)
	System Integrator	No change
Application System Developer	Developing Agency/Contractor	Developer
Approval Authority	Program Decision Authority	Approval Authority
Army Acquisition Executive (AAE)	Army Acquisition Executive	No change
Assigned Responsible Agency	Materiel Developer	MATDEV
Automation Quality Organization	Quality Assurance Organization and/or Software Quality Assurance (SQA)	Software Quality Assurance (SQA) Organization
Configuration Control Board (CCB)	Configuration Control Board	No change
Functional Proponent (FP)	Combat Developer (CBTDEV)	FP/CBTDEV or User Representative
Independent Evaluator	Operational Evaluator	Independent Operational Evaluator
Independent Third Party Tester	Developmental Tester IV&V/LCSEC/SQA	Developmental Tester
Independent Third Party Tester	Operational Tester	Operational Tester
Independent Evaluator	Developmental Evaluator/ Assessor	Independent Developmental Evaluator/Assessor
Logistician	Logistician	No change
Major Automated Information System Review Council (MAISRC)	Army Systems Acquisition Review Council (ASARC)	No change
Materiel Developer (MATDEV)	Materiel Developer	No change

Table 2-2. Organizational Roles Cross-Reference (Cont'd.)

AIS TERM	MSCR TERM	CURRENT TERM
Matrix Support and Testers	Matrix Support, PDSS Personnel, Testers, and Independent Evaluators/Assessors	T&E Team/T&E Community
Non-ADP Operator, Organization	User/Troops/Unit	No change
Program Executive Office (PEO)	Program Executive Office	No change
Program/Project/Product Manager (PM)	Program/Project/Product Manager	No change
Project Officer	Program Manager	PM
Proponent Agency (PA)	Similar to CBTDEV/FP	User Representative
Quality Assurance/IV&V	Developmental Evaluators: IV&V/SQA/LCSEC	Continuous Evaluation
Software Testers	Software Engineering Testers	Software or Developer's Testers
Software Development Center (SDC)	Software Engineers, Life Cycle Software Engineering Center (LCSEC)	AIS - Central Design Activity (CDA) MSCR - No change
Tester	Developmental Tester	Software or Developer's Tester
Trainers	Trainers	No change

Table 2-3. Documentation Cross-Reference

AIS TERM	MSCR TERM	CURRENT TERM
	Computer Resources Integrated Support Document (CRISD)	No change
	Critical Item Development Specification (CIDS)	No change
	Developmental Software Support Environment	No change
	Documentation of Commercially Available/Privately Developed Software	No change
	Independent Evaluation Briefing (IEB)	No change
	Metrics Charts	Metrics Reports
	Outline Test Plan (OTP)	No change
	Prime Item Development Specification (PIDS)	No change
	Software Development Plan (SDP)	No change
Automation Quality Plan (AQP)	Software Quality Program Plan (SQPP)	SQPP
Computer Operation Manual	Computer System Operator's Manual (CSOM)	No change
Computer Operation Manual and Maintenance Manual	Software Programmer's Manual (SPM)	No change
End User Manual (EM)	Training Manuals (for CBTDEV)	No change
Engineering Change Proposal-Software (ECP-S)	Software Change Notice, Engineering Change Proposal (ECP)	No change
Engineering Change Proposal (ECP)	Engineering Change Proposal (ECP)	No change

Table 2-3. Documentation Cross-Reference (Cont'd.)

AIS TERM	MSCR TERM	CURRENT TERM
Functional Description (FD)		Users' Functional Description (UFD) and Functional Description (FD)
Implementation Procedures (IP)	Life Cycle Software Support Environment User's Guide	No change
Implementation Procedures (IP)	Firmware Support Manual	No change
Independent Evaluation Report (Developmental)	Independent Evaluation Report (Developmental)	No change
Test and Evaluation Report (Operational)	Test and Evaluation Report (Operational)	No change
Independent Evaluation Plan (Developmental)	Independent Evaluation Plan (Developmental)	No change
Independent Evaluation Plan (Operational)	Test and Evaluation Plan (TEP) (Operational)	TEP (Operational)
Maintenance Manual (MM) and Implementation Plan (IP)	Software Support Transition Plan	No change
Management Plan (software level)	Computer Resources Management Plan (CRMP)	No change
Management Plan	Program Management Plan	No change
Mission Need Statement (MNS)	Mission Need Statement (MNS)	No change
Operational Requirements Document (ORD)	Operational Requirements Document (ORD)	No change
Problem Reports (PR)	Software Trouble Report (STR)/ Software Problem Change Request (SPCR) Test Incident Reports (TIRs)	No change

Table 2-3. Documentation Cross-Reference (Cont'd.)

AIS TERM	MSCR TERM	CURRENT TERM
Request for Proposal (RFP)	Request for Proposal (RFP)	No change
SAT Test Plan	Test Design Plan (TDP) (Operational)	TDP (Operational)
Software Unit Specification (US) and Database Specification (DS)	Software Design Document (includes database design)	No change
Software Change Package (SCP)	Engineering Change Proposal-Software	No change
Software Unit Specification (US)	Software Product Specifications (SPS)	No change
Statement of Work (SOW)	Statement of Work (SOW)	No change
System/Subsystem Specification and Database Specification	Software Requirements Specification (SRS)	No change
System/Subsystem Specification and Functional Description	System/Segment Specification	No change
System/Subsystem Specification (SS)	System/Segment Design Document (SSDD)	No change
Technical Test Plan (Formerly SQT, PT)	Detailed Test Plan (DTP)	No change
Test Plan (PT)	Software Test Plan (STP)	No change
Test Analysis Report (RT)	Software Test Report (STR)	No change
Test Plan (Section 5) (PT) IAW DOD-STD-7935A	Software Test Description (STD)	No change
Test and Evaluation Master Plan (TEMP)	Test and Evaluation Master Plan (TEMP)	No change
User's Manual (UM)	Software User's Manual (SUM)	No change
Version Description Document (VDD)	Version Description Document (VDD)	No change

Table 2-4. Tools and Techniques Cross-Reference

AIS TERM	MSCR TERM	CURRENT TERM
Audit	Audit	No change
Benchmark Test Files	Benchmark Test Files	No change
CASE Tools	CASE Tools	No change
Checkpoint/Recovery Testing	Recovery/Reconfiguration Testing	Recovery/Reconfiguration Testing
Code Walkthrough	Code Walkthrough	No change
Design Reviews	Design Reviews	No change
Developer's Environment	Host Environment (Software Engineering Environment)	Software Engineering Environment
Development Library (DEVLIB)	Software Development Library	Software Development Library
Development Tools, Toolbox	Development Tools, Toolbox	Dev. .ent Tools
Dynamic Analysis	Dynamic Analysis	No change
Emulation	Emulation	No change
Metrics	Metrics	No change
Parallel Testing	Parallel Testing	No change
Performance Monitors	Drivers, Emulators, Stimulators	Instrumentation, (Drivers, Emulators, Stimulators) Performance Monitors
Program Folders	Software Development Folder (SDF)	SDF
Rapid Prototyping	Rapid Prototyping	No change
Regression Testing/Retesting	Regression Test/Retesting	No change
Reliability	Software Reliability	Software Reliability
Requirements Trace	Requirements Trace	No change

Table 2-4. Tools and Techniques Cross-Reference (Cont'd.)

AIS TERM	MSCR TERM	CURRENT TERM
Simulation	Simulation	No change
Static Analysis	Static Analysis	No change
Stress Testing	Stress Testing	No change
Test Hooks	Test Hooks	No change
Test Bed	Test Bed	No change
Validation	Validation	No change
Verification	Verification	No change

Table 2-5. Software Problem Categories and Priorities

AIS TERM	MSCR TERM	CURRENT TERM
Priority		
Emergency	Priority 1	Priority 1
Urgent	Priority 2	Priority 2
Urgent	Priority 3	Priority 3
Routine	Priority 4	Priority 4
Routine	Priority 5	Priority 5
Category		
Technical Problem	Software Problem	Software Problem
Documentation Problem	Documentation Problem	Documentation Problem
Technical Problem Functional Problem	Design Problem	Design Problem

Note: Current Term priorities and categories are defined in DOD-STD-2167A, Appendix C.

Table 2-6. Software/System T&E Events and Documents

Responsible Organization (Primary = *)	Events & Documents	Reports	Milestones	Tests
User Rep. (FP/PA, CBTDEV)	Operational Reqm'ts Document (ORD) Users' Functional Description (UFD) Critical Operational Issues and Criteria (COIC)	N/A	I,II,III,IV	N/A
PM* & TIWG	Test & Evaluation Master Plan (TEMP)	N/A	I,II,III,IV	All system software & hardware testing
PM* & CRWG	Computer Resources Management Plan (CRMP) (Applies to MSCR only)	N/A	I,II,III,IV	Software testing, supportability issues
PM*, Developer, User	System Requirements Review (SRR)	N/A	Between I & II, or after II; between III & IV for PDSS	N/A
PM*, Developer, SQA (IV&V), User, PDSS	System Design Review (SDR)	N/A	Between I & II, or after II; between III & IV for PDSS	N/A
PM*, Developer, SQA (IV&V), user, PDSS-LCSEC	Software Specification Reviews (SSRs)	N/A	Between I & II or after II; between III & IV for PDSS	N/A
PM*, Developer, SQA (IV&V), user, PDSS-LCSEC	Preliminary Design Reviews (PDRs)	N/A	Between I & II, or after II; between III & IV for PDSS	N/A
PM*, Developer, user	User Demonstrations	N/A	Between I & II, during II & III, between III & IV	User Demonstrations
PM*, Developer, SQA (IV&V), user,	Critical Design Reviews (CDRs)	N/A	Between I & II (prior to II),	N/A

Table 2-6. Software/System T&E Events and Documents (Cont'd.)

Responsible Organization (Primary = *)	Events & Documents	Reports	Milestones	Tests
PM*, Developer, SQA (IV&V), user, PDSS-LCSEC	Critical Design Reviews (CDRs)	N/A	Between I & II (prior to II), or after II; between III & IV for PDSS	N/A
PM, Developer*	Informal software test plans & test descriptions/test cases	N/A	Between II & III, between III & IV	Software developer tests (unit, module, CSC programs) (developer's technical tests)
PM*, Developer	Software test readiness review(s)	N/A	Prior to formal software development tests	N/A
PM, Developer*	Formal software test plans & test descriptions/cases	Software test reports/test analysis report	Prior to formal software development tests	Software developer tests (cycle/system, CSCI/FQTs, system integration) (developer's technical tests)
Software engineers, SQA (IV&V personnel), PDSS-LCSEC/CDA personnel, independent evaluators	Continuous software evaluations	Software evaluations and reports, action items, metrics, and risk analyses	Between I & III, between III & IV, throughout life-cycle	Witness/monitor/participate in software tests, reviews, audits, risk analyses, documentation approval between III & IV. May develop software and conduct software tests
PM*, Developer, PDSS-LCSEC/CDA personnel, SQA (IV&V), etc.	Physical configuration audit (PCA)	N/A	After II but before III	N/A

Table 2-6. Software/System T&E Events and Documents (Cont'd.)

Responsible Organization (Primary = *)	Documents & Events	Reports	Milestones	Tests
PM*, Developer, PDSS-LCSEC/CDA personnel, SQA (IV&V), etc.	Functional configuration audit (FCA)	N/A	After II but	N/A
PM, Developer, PDSS-LCSEC/CDA* personnel	Software maintainability evaluation	Software maintenance eval. report, suitability & supportability statements	After II but before III	N/A
PM*		Developmental Test Readiness Statement (DTRS)	At Developmental Test Readiness Review (DTRR)	Formal DT
PM, FP or CBTDEV, Trainer		Operational Test Readiness Statement (OTRS)	Prior to operational testing	OT
Independent developmental evaluator/ assessor(**) and developmental testers	Independent evaluation/assessment plan(**) & technical issues & criteria	Independent evaluation/ assessment report(s) and test report	I,II,III	Government Developmental Test (formal)
Developmental Tester	Test plan(s),detailed test scenarios, technical issues and criteria (optional IAW AR 73-1)	Test analysis report or test report	Between III & IV	Government Developmental Test

Table 2-6. Software/System T&E Events and Documents (Cont'd.)

Responsible Organization (Primary = *)	Events & Documents	Reports	Milestones	Tests
Independent(**) operational evaluator and operational tester	Test & evaluation plan (abbreviated) and operational issues & criteria	Early Operational Assessment (EOA), Operational Assessment (OA)	During I,II,III	Early User Test and Experimentation (EUTE), Limited User Test (LUT), Force Development Test and Experimentation (FDTE)
Independent operational evaluator(**) & operational tester	Test & evaluation plan (TEP) and critical operational issues & criteria, PT for AIS Class VI	TER or AOA (non-major systems) or RT if AIS Class VI or expanded test report (ETR)	Prior to III for production/ deployment decision	Initial Operational Test (IOT)
Operational tester (independent operational evaluator, if required)	Test & evaluation(**) plan, (critical operational issues & criteria (optional) IAW AR 73-1) or PT for AIS Class VI	Test analysis report, expanded test report (ETR), OA or TER if required	Between III & IV	Follow-on Operational Test (FOT)
Materiel Release Board	Materiel Fielding	Uses TER, AOA, software suitability and supportability tests and PMs [illegible]ective acti[illegible] [illegible]lan	MS III and for software releases after MS III	

(**) Optional for Class V AIS, as directed by [illegible]ISC4. Not required [illegible] Class VI AIS.

Chapter 3
T&E as Part of Acquisition and Development

3-1. Introduction
These procedures present an iterative, structured, and comprehensive approach to software test and evaluation throughout a system life cycle. Specific application of these procedures should be tailored to the technical and management characteristics of each system acquisition program. Software T&E procedures are determined by the level of technical risk which can be allowed in the system acquisition. This chapter discusses general T&E strategies which must be considered to provide effective T&E which is responsive to program needs, user requirements, and fielding of quality systems.

3-2. T&E approach
Software T&E is accomplished within the context of the overall system development and test program. Software T&E supports the overall concept of total quality management (TQM) for the system development. In accordance with the TQM concept, all persons involved in the software development process are responsible for impacting the quality of the software product. The following general guidelines constitute the minimum requirements for a software T&E program.

a. Software is assessed for its ability to support the system effectiveness and suitability. The extent of software T&E applied must be sufficient to provide an acceptable level of risk that ensures system requirements and mission objectives will not be impaired by deficiencies attributable to software.

b. Per AR 73-1, software T&E must provide data to support qualitative and quantitative software metrics. These metrics serve as measures and indicators of the critical technical and operational characteristics that both the software and the integrated system need to achieve.

c. The overall software T&E program must reflect a systematic and measurable process in which continuous software evaluations present a realistic and iterative status report. Clearly defined entry and exit objectives for each phase, metrics and continuous evaluations are the basis for a logical progression of software T&E. This progression is based on demonstrating achievement of objectives at each phase. Figure 3-1 portrays the general correspondence between system life cycle phases and software T&E phases and activities. The exit objectives for each phase are summarized.

d. The software T&E program must support the progressive approach by effectively sharing test and evaluation results across the life cycle phases. Each

Milestone	Phase	MSCR Documentation	MSCR Activities	MSCR & AIS T&E Metrics	AIS Documentation	AIS Activities
MS O	Mission Need Determination/ Concept Exploration and Definition	MNS, TEMP*, CRMP, ORD, Draft UFD, COIC*, TCIC* Draft SSS, IEP/TEP started	TIWG established*, CRWG established*, EOA, OA, Continuous Evaluation, User demonstrations	Cost, Schedule	MNS, TEMP*, ORD, Draft UFD, COIC*, TCIC* IEP/TEP started	TIWG established*, EOA, User demonstrations
MSCR MS I	System Requirements Analysis	RFP/SOW, Final UFD, Draft SSS, Draft CM Plan	Continuous Evaluation, SRR	Metrics above plus: Reqts Traceability, Reqts Stability	RFP/SOW, Draft UFD, Draft FD, Draft CM Plan	Continuous Evaluation, SRR
	System Design	Final SSS, Draft SRS, Draft IRS, Final SQPP, Final CM Plan, Final SDP	Continuous Evaluation, SDR, Functional baseline established	Metrics above plus: CRU SEE, if applicable	Final UFD, Draft FD, Draft SS, Final SQPP, Final CM Plan	Continuous Evaluation, SDR, Functional baseline established
AIS MS I/ MSCR MS II	Software Requirements Analysis	Final SRS, Final IRS	Contiunous Evaluation, SSR, Allocated baseline established	Metrics above	Draft FD, Draft US(s), Draft DS(s), Final SS,	Continuous Evaluation, SSR, Allocated baseline established

PDSS

* Optional events/activities during PDSS. Documents during PDSS updated, not drafted.

Figure 3-1. Life Cycle Activities

	MSCR		MSCR & AIS	AIS	
	Documentation	Activities	T&E Metrics	Documentation	Activities
Preliminary Design	Draft SDD (prelim. design), Draft IDD, STP (tests identified)	Continuous Evaluation, PDL produced, PDR(s), User Demonstrations	Metrics above plus: Design Stability, Complexity	Draft US(s) (prelim. design), Draft DS (prelim. design), SDT Plan (tests identified)	Continuous Evaluation, PDR(s), User Demonstrations
Detailed Design	SDD (detailed design), Final IDD, STD (test cases)	Continuous Evaluation, PDL produced, CDR(s), User Demonstrations	Metrics above	Final US(s), Final DS Final FD	Continuous Evaluation, CDR(s), User Demonstrations
Code and Unit/ Module Test	Source Code Listings	Continuous Evaluation, Audit informal unit test SDFs	Metrics above plus: Breadth of Testing, Depth of Testing, Fault Profiles	Source Code Listings	Continuous Evaluation, Audit informal unit test PFs
CSC/Program Integration and Test	STD	Continuous Evaluation, Audit informal test SDFs, TRR	Metrics above	Final SDT Plan, UM, EM	Continuous Evaluation, Audit informal unit test PFs, TRR

AIS MS II

PDSS cont'd.

Figure 3-1. Life Cycle Activities (Cont'd.)

AIS/MSCR MS III

	MSCR		MSCR & AIS T&E Metrics	AIS	
	Documentation	Activities		Documentation	Activities
CSCI/Cycle/ Subsystem Test, System Integration Test	STR(s), SPS, CSOM, SPM, VDD, SUM, DTRS	Formal Tests (FQT), FCA, PCA, Maintainability Evaluation	Metrics above plus: Reliability	RT, OM, MM, IP, DTRS	Formal Tests (System/ Cycle), FCA, PCA, Maintainability Evaluation
Government Developmental Test and Evaluation (DT)	IEP/IAP/TDP if evaluated/assessed*, IER/IAR if evaluated/assessed*, DTP, TR	DTRR, System DT	Metrics above	IEP/TDP if evaluated*, IER if evaluated*, TP, RT	DTRR, System DT
Operational Test and Evaluation (OT) (IOT if MS III, FOT if PDSS)	TEP, DTP, ETR, TER/AOA*, IEB*	OTRR, System IOT or FOT	Metrics above	TEP, DTP, ETR, TER/AOA*, IEB*, PT, RT (Class VI AIS systems only)	OTRR, System IOT or FOT
Milestone Review*	TER or AOA*, PM Corrective Action Plan	Report TER or AOA*, Verify corrective actions, Report metrics, Product baseline established if MS III	As applicable	TER or AOA*, TR, PM Corrective Action Plan	Report IER or AOA*, Verify corrective actions, Report metrics, Product baseline established if MS III
Materiel Release	Software Supportability and Suitability Statement	Materiel Release Board	As applicable	Software Supportability and Suitability Statement	Materiel Release Board

PDSS begins - return to first page

PDSS cont'd.

AIS/MSCR MS IV

PDSS continues, system is retired, or new reqts, return to MS 0

Figure 3-1. Life Cycle Activities (Cont'd.)

element of the software T&E program must provide data to support software and system acquisition decisions.

e. Software T&E must support the acquisition management process. Individual programs and acquisition strategies determine the scope of software T&E programs to fit the acquisition.

3-3. Test and evaluation considerations

a. The most efficient and effective use of resources is the sharing of data among developers, testers and evaluators. For any system, software testers and evaluators need to approach and plan their strategies with an understanding of the complexity of the system, the development cycle, the acquisition category, the deployment philosophy, and the other players involved. Factors such as the acquisition category determine the reporting and approval requirements, and the requirement for independent evaluation. Materiel release requirements are an additional consideration since the PDSS activity has to provide a software supportability and suitability statement for fielding decisions.

b. Differences in the inherent characteristics of system computer resources and software architectures dictate a variety of software T&E methods and procedures. These methods and procedures are required to address different types of software structures and to collect different types of data which are meaningful for software evaluation. The most significant requirement for selecting software test methods is understanding the objectives and data requirements for that phase of software T&E. The amount and intensity of software testing must be established early in the development process. Test procedures must be developed simultaneously with the software. Selection of software T&E techniques depends on several factors, including:

(1) Overall complexity of the system and software.

(2) Extent of critical technical and operational characteristics.

(3) Level of technical risk in the software's development.

(4) Target environment and intended end use.

c. Single-site systems are systems which reside only at one location. As part of the strategy for these systems, additional T&E considerations include arrangements for testing and realistic methods of testing. An additional test design consideration is operational tests during PDSS as there may be test limitations associated with single-site systems. This may dictate the use of combined DT/OT. An example of a single-site system is the Army central-site financial systems which reside on large mainframes at one location.

(1) Test designs for single-site systems must account for:

(a) Loading and running the system in specialized test regions which are partitioned from the production regions.

(b) Running the volumes and stress loading necessary to simulate or stimulate expected interactions with users, other systems or the external environment. This may require the use of models. (Models for T&E purposes are required to be accredited by an activity independent of the model developer.)

(c) Ensuring that all cycles are executed, whether by models or actual testing, including end-of-year, and other cycle roll-ups.

(2) Test and evaluation strategies for these systems must consider all opportunities to gather data throughout design and development. Models developed for stress loading systems for T&E purposes must be accredited prior to use by independent evaluators. System contractor models will not be used for operational testing (OT) and evaluation without an independent certification that they accurately portray the external interactions.

d. Single-user systems are systems designed for use by one user organization. Presence of a single-user organization allows direct user involvement throughout development and the T&E process. It is essential that the operational users be part of the T&E planning to ensure that specialized operations are not overlooked.

e. Non-theater/tactical systems include sustaining-base and strategic systems. Strategic systems normally are managed under DOD and JCS publications and, occasionally, AR 525-1. Strategic systems may be developed under 25-series policies. Sustaining-base systems provide the capability to raise, organize, train, equip, deploy and sustain Army forces in accomplishing the operational mission. These systems are located at the garrison or installation level and do not physically move into the battlefield during mobilization or wartime. They may perform differing missions during peacetime, mobilization, wartime and demobilization, and they may reside on mainframes or be centrally-sited single-user systems. These large scale systems have unique T&E considerations. (Refer to AR 25-3.)

f. Theater/tactical systems are systems which operate in a defined area of the operational theater. These are systems which, unlike sustaining-base, focus on combat and wartime missions. Theater/tactical systems must respond to additional design considerations related to operational environment and real-time processing. (Refer to AR 25-3.)

g. MSCR refers to computer resources acquired for use as integral parts of weapons systems, command and

control, communications, intelligence and other tactical or strategic systems and their support systems. This term applies to all computer resources (hardware, software, documentation, data, etc.) associated with specific program technical T&E, user T&E, and post-deployment support including trainers, automatic test equipment, land-based test sites, and system integration and test environments. Software T&E must address several unique characteristics including real-time, security, and fault tolerance requirements. (Refer to AR 70-1.)

h. Automated information systems encompass the functions, resources, equipment, software and activities associated with one or more of the disciplines of automation, telecommunications, visual information, publications and printing, and records management. They are most often non-theater/tactical systems. (Refer to AR 25-3.)

3-4. Security accreditation and its relation to software T&E

a. All AIS and MSCR systems which contain information require safeguards to protect against compromise, subversion, or unauthorized manipulation. Information is safeguarded by hardware security, software security, procedural security, communications security, personnel security, physical security, network security, electronic security, and control of compromising emanations. Security accreditation is the process which reviews the layers of safeguards. Accreditation is the procedure for determining the level of security, the risks, vulnerabilities, and the planned safeguards.

b. Accreditation results from the process of collecting, analyzing, and submitting information pertaining to the security approval for software systems. The process of security accreditation is described in Army Regulation 380-19 for "Information Systems Security." This regulation introduces information system security (ISS) as a discipline encompassing communication security (COMSEC), computer security (COMPUSEC), electronic security (ELSEC), and control of compromising emanations (TEMPEST). The designated accreditation authority (DAA) is a senior management official who has the authority and responsibility to decide to accept or reject the security safeguards prescribed for an automated information processing system and who may be responsible for issuing an accreditation statement or certificate that records the decision to accept those safeguards for his/her department, agency, or service. A DAA will be identified for all AIS and MSCR systems processing classified or unclassified-sensitive information. (Reference Section 3-8 of AR 380-19 for

the appointment of a DAA which is dependent upon the sensitivity or classification of the system.)

c. Software test and evaluation personnel assist in accreditation efforts. AR 380-19 states that software design and test activities are part of the software certification and accreditation process. T&E activities and responsibilities for accreditation are:

(1) Audits of control procedures used to develop software.

(2) Requirements for software to be completely tested before becoming operational.

(3) Requirements for testing which must include valid and invalid data.

Software testing is not complete until all security requirements have been examined and expected results are attained.

d. The accreditation process requires the following (see AR 380-19 for details):

(1) Development and modification of a security plan (IAW AR 380-19, Appendix C).

(2) Determination of accreditation objectives.

(3) Completion of risk management reviews.

(4) Definition of proposed operations.

(5) Selection of security countermeasures.

(6) Certification (IAW AR 380-19).

(7) Development of a security guide.

e. Software T&E personnel need to be familiar with the safeguards for security and the accreditation requirements IAW AR 380-19. Security issues and requirements are an integral part of the comprehensive T&E strategy for fielding secure, trusted systems.

3-5. Metrics and T&E

a. Metrics are technical and management tools used to highlight and identify potential problems and/or deficiencies. They are quantitative and qualitative measures and indicators which help focus management attention and, if appropriate, resources on the prevention or correction of problems.

b. Metrics measure and provide feedback, impacting both the product and process, and enable managers to continuously improve the process. Metrics are an integral aspect of controlling and reporting software T&E activities. They are required for Army software development and T&E. Metrics may be developed, collected, and used by many people (e.g., developers, evaluators, PDSS, software engineers, testers, SQA, IV&V, etc.). Metrics are reported to evaluators, PM/PEO, and review council decision-makers. Figure 3-2 depicts representative metrics during the life cycle of a typical waterfall model acquisition strategy. The definitions and uses of these metrics are described in Software T&E Metrics, of this part of DA Pamphlet 73-1.

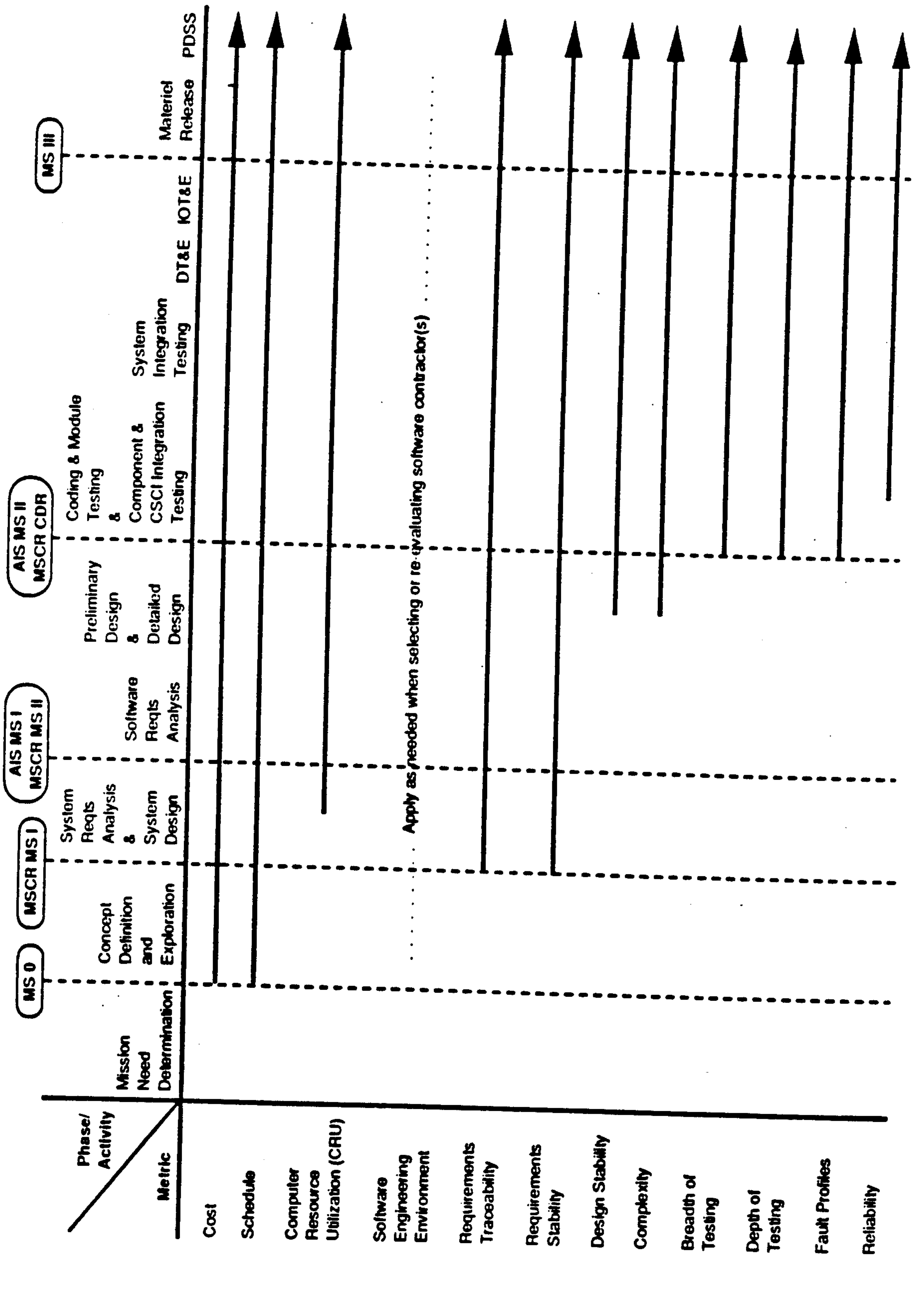

Figure 3-2. Examples of Software Metrics During the Life Cycle

3-6. Tools and related techniques
Integrated development, design, test and evaluation activities use a variety of techniques including modeling, simulation, drivers, stimulators, and other tools.

a. Modeling and simulation (M/S). Modeling and simulation are often utilized in software T&E to validate software design throughout the life cycle. M/S can be developed to replicate any level of the system or software architecture. Significant technical risk can be mitigated by early use of M/S in software T&E. The extent of risk mitigation depends highly on the validity of the model as compared to the actual system. Use of simulation and modeling includes, but is not limited to, the identification of test parameters and drivers for field tests; determination of high risk areas; prediction of test results; assisting in the allocation of scarce test resources; and the assessment of system capabilities in situations which cannot be tested due to safety, cost, or other constraints. The extent of the use of M/S; whether existing M/S will be used or new M/S will be developed; status of M/S verification, validation, and accreditation; and the degree to which M/S will augment test data to assist in system evaluations and assessments will be documented in the TEMP. Models and simulations must be accredited and validated prior to their use for T&E.

b. Tools and instrumentation.

(1) To implement a comprehensive software T&E program, early consideration must be given to resourcing T&E assets to do the job. Test tools, such as bus analyzers, devices to load or drive the software, emulators, stimulators, specialized error seeding software, and various other tools and instrumentation are necessary to accomplish T&E objectives, especially to ensure that loads and stresses are exercised.

(2) Testers and evaluators need to ensure the planning, development, funding, validation and accreditation of tools and instrumentation are reflected in the statement of work, request for proposal, Section V of the TEMP, "T&E Resources," the outline test plan (OTP), five-year test plan (FYTP), and other resource documents. These tools and those used by developers must be accredited for use for T&E purposes IAW AR 73-1.

(3) A particularly effective method is to have tools and instrumentation developed by agents independent of the software developer. This provides an excellent and additional means to verify requirements as implemented in the design.

(4) Some system developments may dictate the requirement for a suite of tools, hardware, software

and devices which may constitute a test bed environment. Developers, software engineers, testers and evaluators should identify and plan for these needs early in the system life cycle to ensure availability at test time.

3-7. Prototypes and T&E

Software prototypes are normally development tools, not a testing technique or a substitute for system development, testing and configuration management (CM). However, these tools can be an important part of the software development methodology. Informal software releases refer to software which is used for engineering design and development. These informal software products are usually poorly documented, lack adequate design certification, and are not subject to configuration management procedures. Informal releases will not become part of an approved releasable software baseline because they present an unacceptable level of technical risk until they are part of the approved baseline. Informal releases of prototypes are encouraged to be utilized for user demonstrations, early looks at the software-human interface designs, and early requirements refinements. Formal T&E demands defined and documented requirements; informal T&E does not necessarily require these. In the event that the development plan allows for the eventual operational use of prototype software, those prototype units must be properly tested and documented.

3-8. T&E in support of tailored acquisition approaches

The Development and Acquisition Test and Evaluation Procedures, of this document describes the software T&E process for the standard acquisition strategy. However, tailored acquisition approaches are used and need to be considered for their risks and impact on the software T&E process. Three examples of tailored acquisition approaches are: non-developmental items, the use of concurrent or combined DT and OT, and accelerated development/fielding.

a. Non-developmental items (NDI) and software.

(1) The NDI approach is the acquisition of a product that is already developed for another purpose or another user. It is chosen because it is supposed to be capable of performing the mission. NDI systems can be the means to field a system faster and cheaper with little or no new development effort. For many systems, computer hardware is NDI.

(2) Software frequently fits in the NDI category because it may be off-the-shelf. However, NDI software may not always be off-the-shelf, but may be a combination of off-the-shelf and newly developed software. NDI software which requires modification or system integration must undergo software T&E. If the

developer is required to perform these tests, the Government T&E community reviews the test plans and monitors the performance to evaluate the adequacy of testing. Results of this evaluation are reported during readiness reviews prior to the start of Government testing.

(3) NDI software may not require Government developmentaling. In all cases, operational testing is conducted to ensure that the NDI software can perform the mission. NDI operational testing is performed by a designated Government organization. The requirement for independent evaluation of NDI software/systems will be determined IAW AR 73-1.

(4) NDI executive software will be validated during operational testing using a representative functional application. No executive software can be released or used with an application until it has successfully completed a operational test. (Executive software includes compilers, utilities, operating systems, special customized system software, etc.)

(5) NDI software testing emphasizes the following:

(a) That the software meets contract requirements.

(b) Developer's enhancements or adaptations should perform correctly and not introduce new defects.

(c) Developer-provided documentation is adequate to permit suitable operation and maintenance of the software product in its intended user and maintenance environment.

(d) Software meets the user's stated requirements and the operational mission.

(6) Software developments which use NDI hardware must also plan to ensure that the software can run effectively and efficiently. Special testing considerations include:

(a) Software integration with hardware should demonstrate that performance characteristics are met.

(b) The integrated system (hardware, software, documentation) meets user's stated requirements, and is mission effective and suitable.

(c) Hardware PM, software PM, and software developers must work closely to ensure that the system works. Early availability of target hardware during development reduces risks associated with integration.

(7) The T&E community needs to carefully review and understand plans which incorporate NDI in the acquisition strategy. Documentation, evidence of testing, extent of software modifications and eventual software supportability are areas which impact T&E.

b. Concurrent and combined DT and OT.

(1) Concurrent DT and OT occurs when DT and OT are conducted on separate identical systems simultaneously. Combined DT and OT are conducted on

the same system with the DT portion usually preceding the OT portion. In some cases, combined DT and OT are conducted simultaneously on the same hardware platform. For any of these approaches, separate evaluations are performed by developmental and operational evaluators, if required. All these approaches have inherent risks, although a combined sequential approach is the least risky of the three because technical aspects are dealt with first. Since completion of a successful DT usually serves as a basis for entering OT, the lack of DT forces developer testing to be the basis of OT. Thus, the benefits of wringing out software problems affecting system performance, as done in DT, are lost. The risk of failing OT is increased.

(2) Risks of combined or concurrent DT and OT can be reduced by technical and operational evaluators having early involvement in defining test strategy. Risk factors such as whether existing or new technologies are used and lessons learned from past failures and successes of similar system acquisitions should be considered. This will lead to the most realistic and, in the long-term cost effective, approach to successful system acquisition.

c. Accelerated development/fielding. This strategy is a variant of incremental acquisition and is applicable for software intensive systems, particularly AIS, where user functionality can be cleanly divided into standalone blocks which can be designed, developed, and tested at an operational level with a high degree of independence and hopefully parallelism as well. Each successive block provides increased functionality for the users or adds integration capability necessary for communicating with other systems. An IOT for each software block is performed on a testbed culminating in an IOT.C and Milestone III.C, where "C" refers to fielding certification. The testbed is expanded as needed for each successive IOT. Following a successful IOT.C, authorization for purchase of the full hardware and software complement for all users occurs and the system is fielded for their employment. This strategy is primarily appropriate for low to medium risk programs when user requirements can be fully defined and very little special purpose hardware or development software is required. This strategy makes heavy use of NDI hardware and software and prototyping.

3-9. T&E and risk management.
As well as describing current Army testing policies, the procedures and guidelines in this part of DA Pamphlet 73-1 attempt to show the relationship of software products and functions as integral components of the larger systems of which they are a part. Software T&E, continuous evaluation, incremental

working-level reviews, increased user involvement in software processes, software metrics and other strategies are described herein as means to increase knowledge, awareness and control of the software development and maintenance process throughout a system's life cycle. This additional insight will assist in highlighting areas of technical risk more uniformly at earlier stages so that they may be addressed more expediently than in the past.

3-10. Test failures

a. There are several ways to deal with test failures. During early phases of test, which are characteristically controlled by the developer, software problems causing test failures are documented, analyzed, fixed, and retested until solved.

b. Test failures become more complex and impacts are greater once the software is integrated into the system. Although this part of DA Pamphlet 73-1 is structured in the positive, some attention needs to be directed to those circumstances when testing indicates failure. If errors are, in fact in the software being developed, finding them early is the most valuable occurrence for the developer. Identifying problems early enables managers to focus resources where there is a high payoff. Once such problems are corrected, our confidence in the system's ability to do the job is measurably increased.

c. At the system level, during Government developmental or operational test, failures can be very complex. Because of complexities, there is a need to collect data samples which are statistically relevant and to analyze them to determine whether or not the stated issues are met. When issues are not met or the system performs very poorly and time is wasted, the tester and independent evaluator or assessor need to take action. Depending on the severity of test failures, the following actions may occur:

(1) Test is suspended IAW AR 73-1.

(2) Severe and serious deficiencies may dictate get-well plans that take a long time to correct (e.g., reliability growth). In these cases, tests may need to be terminated.

(3) If test results indicate failure but the data show the failure was marginal, then the tester and evaluator/assessor may want to meet with the PM to work out a course of action.

(4) A corrective action plan (CAP) may be prepared by the PM to address the failed issues, corrective actions taken, and retesting performed. IAW AR 73-1, corrections of deficiencies adversely affecting a system's operational effectiveness and suitability will be verified by the independent developmental and operational evaluators. The

evaluators will make maximum use of all testing and other data sources to assess issues and to minimize follow-on operational testing.

(5) If testing is suspended and corrective actions occur, the testers and evaluators need to determine the extent of retest. Generally, if failure occurs during DT, the test integration working group (TIWG) will be convened to determine necessary retest to validate fixes and also the extent of retest to ensure validity of data collected. Readiness reviews will be held before technical retesting and commencement of operational tests.

d. System test failures caused all or in part by software must be tracked, corrected and retested. Prior to large-scale system level testing it should be ensured that any software problems causing system level problems or failures on previous tests have been corrected and adequately tested at lower software levels.

3-11. Configuration management and software T&E

A complex product such as an MSCR or AIS system is built through the development and integration of many smaller items (subsystems, components, assemblies, and parts). The integrated arrangement of all these items is called the "configuration" of the system. Configuration management is an engineering support discipline that simply defined, identifies the characteristics of each item in the system and controls all changes to that item (i.e., it manages the configuration). It is applicable to both the hardware and software items in the system. The configuration management function supports the test and evaluation efforts by identifying, storing and controlling the software products at each stage of the development. These activities ensure that the products, exactly as tested or evaluated, are available for further testing, evaluation or integration. Proper control of the products provides a working baseline against which the test and evaluation function can measure the progress of technical and operational performance as the system proceeds through development.

a. Configuration management considerations. Acquisition of MSCR and AIS systems is defined by traditional system acquisition life cycle models consisting of four or five program phases separated by major decision points (milestones). Each milestone has certain decision criteria that must be met before authorization is given to proceed into the next program phase. Individual system acquisition strategies may result in skipping or merging life cycle phases in some programs, but the prerequisites for each phase or milestone must still be attained prior to proceeding into the next phase. The following paragraphs discuss

each of the phases, in the order in which they are normally achieved in a traditional system acquisition. For each item, both the MSCR and AIS terms are provided, and the configuration management efforts are summarized.

(1) Concept exploration/definition or concept development (Milestone 0 through I, may also be through Milestone II for MSCR). The configuration management function supports the initial test and evaluation efforts by identifying and controlling the approved versions of the initial planning documents, such as the acquisition strategy, the system decision paper and the test and evaluation master plan (TEMP). Normally the system/segment specification and the functional description are authenticated toward the end of this phase, establishing the MATDEV's functional design baseline. A configuration control board is established by the Army Program/Project Office and formal configuration control is initiated. Any software developed for exploratory reasons during this phase is not normally subject to configuration management, although the specification and control of the functional requirements for this software may be desirable. The configuration management office develops the system configuration management plan (CMP) and prepares the configuration management related inputs for the concept demonstration or validation contracts.

(2) Requirements definition and software design (AIS Milestones I - II, MSCR Milestones II - III). The configuration management function supports the test and evaluation efforts by identifying and controlling the system baselines against which the system is to be tested and evaluated. During this phase, system engineering efforts and analyses are conducted to determine the best allocation of system requirements among hardware, software, personnel, and facilities. The software requirements are partitioned into a set of software requirements specifications (SRS), interface requirements specifications (IRS), or system/subsystem specifications (SS). One or more software specification reviews (SSRs) are held to determine the adequacy of the software requirements allocation efforts and the adequacy of the software specifications. The set of development specifications may be authenticated toward the end of this phase, resulting in the establishment of the allocated baseline, or deferred to the next phase.

(3) Software coding through system integration (AIS Milestone II - III, MSCR Milestone II - III). The configuration management function supports the test and evaluation efforts by identifying and controlling the contractor's test planning documents such as the software development plan (SDP), software test plan

(STP), or the test plan (PT). In this phase, the software elements of the system are developed, tested and evaluated. As the contractor's test program is defined and implemented, the configuration management function stores and controls the test documentation, such as the software test descriptions (STDs). The configuration management function also controls and stores the products of the software development, as they are being coded, tested and evaluated, such as the software design documents (SDDs), interface design documents (IDDs) or software unit specifications (US) and data base specifications (DS). A functional configuration audit (FCA) is accomplished for each software item to ensure that the item, as tested and evaluated, meets its requirements as identified in the allocated baseline. The FCA uses the software test report (STR) or the test analysis report (RT) as one of the bases for evaluation of the software performance. A physical configuration audit (PCA) is normally conducted on the first production configuration item (CI), which may occur during the low rate initial production or after the Milestone III decision on the first full rate production item. The PCA is conducted to ensure that the coded software in the production item is accurately and completely reflected in its associated documentation. After successful completion of the FCA and PCA, the CI's configuration identification is entered into the product baseline.

(4) Production/deployment or deployment and operations (AIS and MSCR Milestones III - IV). Since the software is normally fully developed during the engineering and manufacturing development or system development phase, the software activities are concerned with resolving identified deficiencies, making changes to the software that are required by production changes in the hardware, and identifying and developing enhancements to the software. The transition of software support from the contractor to the Life Cycle Software Engineering Center (LCSEC) or the Central Design Activity (CDA) is normally executed in this phase, depending on the suitability of the software and the ability of the LCSEC/CDA to perform adequate life cycle software support. The configuration management function supports the test and evaluation efforts by identifying and controlling the approved versions of transition and installation documents, such as the software support transition plan (SSTP) or implementation plan (IP). The major configuration management effort during this phase is concerned with maintaining change control and status account of the established baselines. The information in the technical data package, including the software documentation programmer's manuals, version description document (VDD), etc., is entered into the Army's

Automated Technical Data/Configuration Management System (TD/CMS). All changes to the established baselines must be formally processed, tested and approved prior to implementation.

Chapter 4 Building the Software T&E Team

4-1. Purpose

This chapter discusses forming the PM's T&E team and the various T&E working groups. The acquisition planning performed by the PM also requires input from software T&E organizations to ensure that a viable T&E program is established and maintained. The types of personnel identified for the team are independent testers (developmental and operational), independent evaluators (developmental and operational), SQA personnel, life cycle software engineering personnel, and IV&V personnel, if applicable. Early meetings with the PM, PEO, materiel developers, (or contractors, if applicable) and the other members of the team are paramount. These meetings address the operational and Government developmental test concepts. Issues discussed are: test bed design, development strategy, configuration management, instrumentation, test files, proposed test dates and the T&E concept.

4-2. Software T&E organizations and responsibilities.

a. The organizations responsible for the following activities are identified by the PM. Many of the organizations must be involved during mission need determination in order to provide early planning, assessment, and structure to the system/software development and T&E. The software T&E personnel are part of the PM's system acquisition team to provide T&E support which is technically knowledgeable in software design, performance, and capabilities. Their purpose is to enhance and improve the exchange of information, prevent duplication of testing and data collection, and provide the PM with information to make decisions. Table 4-1 identifies the T&E personnel and their responsibilities. It describes the general categories of T&E team players and provides examples to identify the Army organizations. Figure 4-1 depicts T&E team level of involvement throughout the T&E process. This represents a normal acquisition. Members of the team are:

(1) Users' representatives. These are the designated combat developers, functional proponents and/or proponent agents. They define and refine user needs and requirements to the developer, T&E people, PM and others. They are integral to ensuring that the system meets the stated user needs and requirements. They <u>must</u> be involved throughout the entire process as a constant monitor to achieve the user needs.

(2) Software development organization. The software developer is the organization designated to design and develop the software. A software developer will be identified when the concept evaluation requires advanced demonstration of software as part of the

Table 4-1. Chart of Responsibilities in T&E

Organization	Examples	T&E Responsibility
Materiel Developer (MATDEV) Also known by other names including: Matrix Support, Assigned Responsible Agency, Assigned System Developer, PM's Matrix Support, Developer, System's Engineers, SQA, IV&V, PDSS-LCSEC/CDA, Software Engineers	Army Materiel Command major subordinate commands (CECOM, MICOM, TACOM, AVSCOM, AMCCOM) Information Systems Command (ISEC, ISSC, (CDA-W, CDA-L, CDA-A, CDA-H)) Corps of Engineers Medical Research and Development Command Strategic Defense Command MACOMs (for assigned information systems only)	Research, development, T&E acquisition of assigned systems in response to approved user requirements. Primary T&E role for ensuring support to the PM. - T&E support in designing, planning, executing, assessing, and reporting technical T&E programs. - Effective and timely system integration during system development to allow for T&E of total system. - Provide adequate and efficient design reviews, audits and quality assurance in support of the T&E program for the system being acquired. - Provide IV&V activities during software development.
User's Representative Also known as Combat Developer (CBTDEV) or Functional Proponent (FP) or Proponent Agent (PA)	TRADOC Corps of Engineers DISC4 INSCOM Health Services Command Criminal Investigation Command Information Systems Command	Formulating doctrine, concepts, organization, materiel requirements and objectives, prioritizing materiel needs, and representing the user in the materiel acquisition process. Coordinates with PM & MATDEV on matters pertaining to area of expertise. Staff agency responsible for the subject area in which IMA resources are used or are planned for use, including

Table 4-1. Chart of Responsibilities in T&E (Cont'd.)

Organization	Examples	T&E Responsibility
User's Representative (Cont'd)	Any DA staff section or MACOM may be an FP for AIS sytems	automation in support of the function performed. Develops and documents Critical Operational Issues and Criteria.
Program Executive Officer (PEO)	PEO-CSS, PEO-STAMIS, PEO-IEW, PEO-FS, etc.	Responsible for administering a defined number of major or non-major acquisition programs. PEOs report to and receive direction from the Army Acquisition Executive (AAE). Ensures comprehensive T&E and QA program including independent T&E and QA developed and executed for assigned acquisitions.
PM, also known as: Project Officer (non-major programs), Program/Project/Product Manager, Program Sponsor, Systems Manager, Operational Manager (during PDSS)	PM-CCTT, PM-OPTADS, PM-SADARM, PM-ABRAMS, PM-SIDPERS, PM-ILOGS, MACOMs, etc.	Chartered to conduct business on behalf of the Army. Reports to and receives direction from either PEO or AAE & is responsible for the centralized management of an acquisition program. Responsible for planning and executing comprehensive T&E program including TEMP preparation, coordination, distribution, maintenance; establishment of TIWG; conducting DTRR, preparing DTRS and OTRS; assuring conduct of developmental T&E IAW AR 73-1; providing system support and training packages. Responsible (with matrix support) for continuous evaluation.

Table 4-1. Chart of Responsibilities in T&E (Cont'd.)

Organization	Examples	T&E Responsibility
Developmental Tester	TECOM (CSTA) ISEC MACOMs who are MATDEVs For assigned AIS AMC (major subordinate command) may be different organization during PDSS (e.g. SQA)	Army command or agency which plans and conducts Government developmental testing, including software testing, qualification testing, technical feasibility testing, etc. Tests are reported IAW AR 73-1.
Developmental Evaluator/ Assessor	AMSAA ISEC TECOM (assessor) LEA	Command or agency that addresses acquisition of effective, supportable and safe systems by assisting in engineering design & development, and determining the degree to which the technical characteristics of the system have been achieved. Performs continuous evaluation on assigned systems. Evaluations/assessments are made to PM and ASARC/MAISRC.
Operational Tester	OPTEC-TEXCOM INSCOM MACOMs for Class VI AIS and others as assigned ISC (ISEC) (only during PDSS of selected AIS systems)	Army command or agency that conducts EUTE, FDTE, IOT, FOT, OSUT. All ACAT I, II, III, IV and MAISRC (AIS Classes 1-4) require independent operational testers (independent of MATDEV, user, and PM).

Table 4-1. Chart of Responsibilities in T&E (Cont'd.)

Organization	Examples	T&E Responsibility
Operational Evaluator	OPTEC-OEC INSCOM HSC (medical materiel only IAW AR 73-1 and AR 40-60)	Army command or agency that addresses effectiveness and suitability of the acquired/developed systems by determining the degree to which the system's operational issues and criteria have been satisfied. Performs continuous evaluation on all assigned systems. Required to be independent of MATDEV, user and PM. Directly reports evaluation to ASARC/MAISRC.

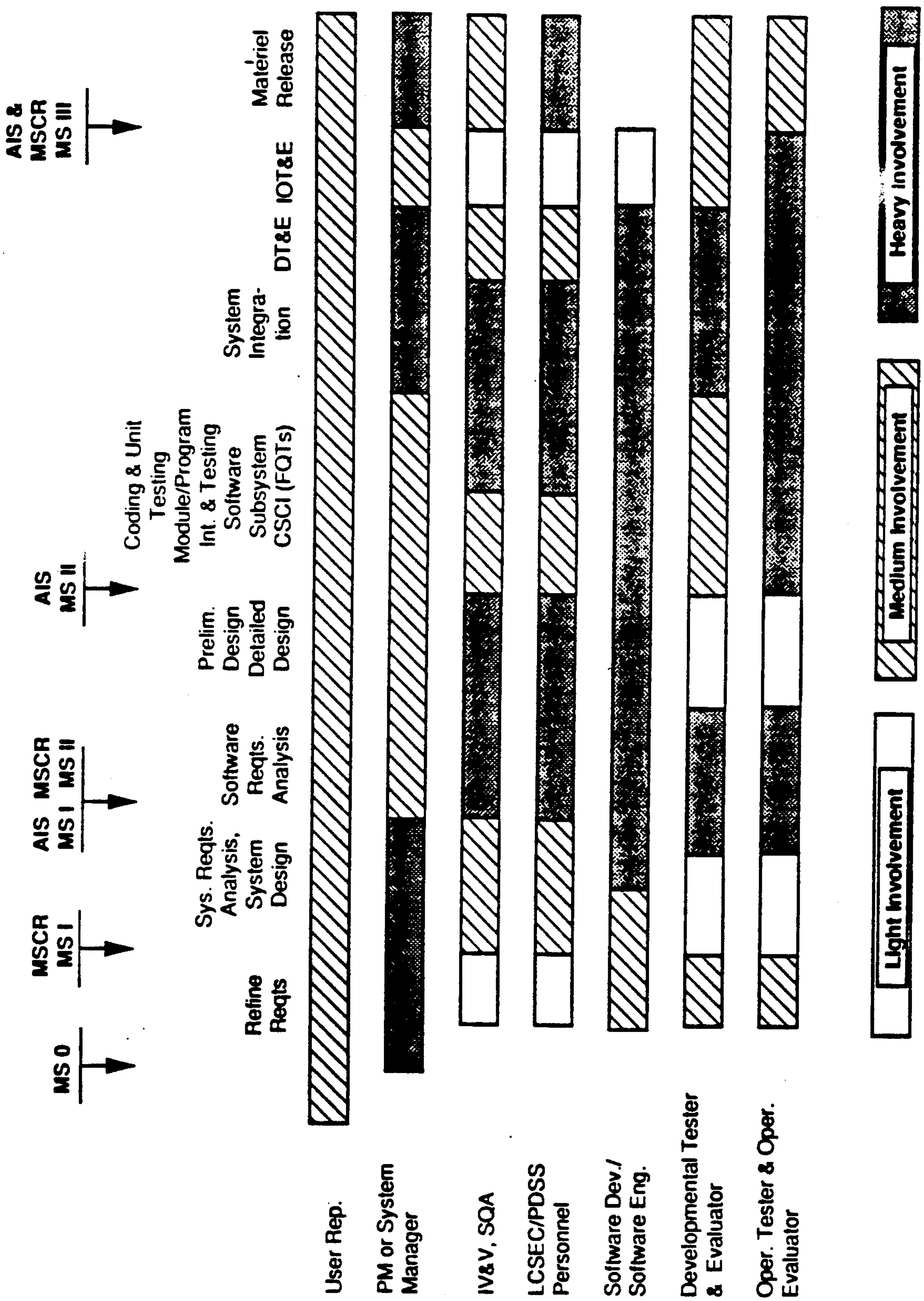

Figure 4-1. Level of Involvement in Software T&E

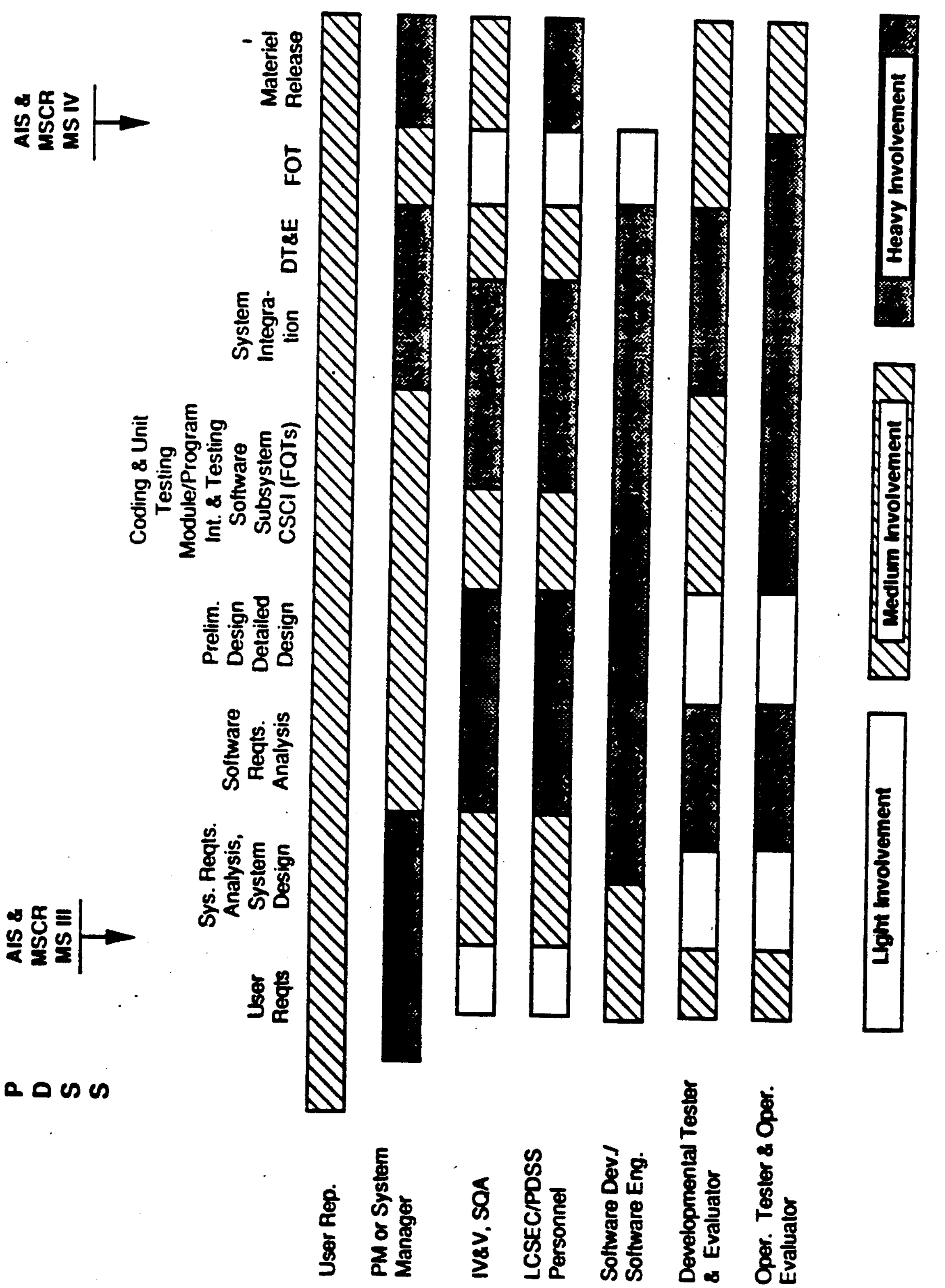

Figure 4-1. Level of Involvement in Software T&E (Cont'd.)

concept definition process and to reduce risk. The software developer(s) used during early phases may or may not be the same as those who will design and develop the production software. The software developer is responsible for testing the software during development as stated in work directives or the contract. Examples of software developers are: Central Design Activity (CDA), contractors, Center for Software Engineering (CSE), and Life Cycle Software Engineering Centers (LCSEC).

(3) Software developer's internal QA. This organization is related to the software developer because they provide the internal QA for software design development and some test activities. These personnel report to management other than the software coders/designers. They may all be part of the same contractor or developer, but do not report through the same chain. They perform audits, evaluate metrics, and similar activities as described in paragraph (4) below. An example of an Army software developer's internal QA organization is the Quality Improvement Office (QIO).

(4) Software quality assurance organization. PM's SQA personnel are generally matrixed to the PM. They are responsible for providing software quality evaluations throughout the acquisition. As requested by the PM, SQA may assist in conducting software reviews (e.g., software specification reviews (SSR), preliminary design reviews (PDRs), critical design reviews (CDR), test readiness reviews (TRR), etc.). SQA personnel participate in software walk-throughs, audits, analysis of metrics, and other similar activities. SQA efforts also include management or participation in the software test program and software support transition. An example of a SQA organization is the Quality Assurance Directorate (QAD).

(5) Post-deployment support organization. This organization is the Army agency responsible for software maintenance management. This organization provides evaluation of software development risks. It also plans for software support, transition, maintenance demonstrations, and prepares the software suitability statement for materiel release. Additionally, this organization may also assist the PM in managing the software development effort. These efforts may include presiding over software related reviews (e.g., SSRs, PDRs, CDRs, and TRR) and managing or participating in the software test program and software support transition. Examples are CDAs, LCSECs, CSE, and contractors.

(6) Independent test organizations. These groups provide test planning and coordination with the software/system evaluators. Independent testers are not part of the development organization. They provide the PM with independent developmental testing or

operational testing support throughout the life cycle. Operational testers are required to be separate and independent from the materiel developer (MATDEV), and the procuring and using agencies. Examples are OPTEC-TEXCOM (operational tester), TECOM (developmental tester), and ISEC-QAD (developmental tester).

(7) Independent evaluation organizations. For those systems requiring independent evaluation, they participate in concept definition evaluations by providing early developmental or operational system/ software evaluations. These evaluations are based upon data available during this part of the life cycle. Issues and criteria determine what data should be evaluated. Government developmental and operational evaluators are not part of the development organization or the PM's office. Developmental and operational evaluators will report to the decision-makers at each milestone. For systems which have no IV&V agent, developmental and operational evaluators may be required to prepare additional reports for the CDR. Operational evaluators must be separate from the materiel developer and the procuring and using agencies. Examples are ISEC-SAO and OPTEC-OEC.

(8) Independent verification and validation organizations. The PM determines the level of software risk associated with the program. The PM may elect (and is strongly encouraged) to use IV&V personnel as a means to reduce and manage risk, provide additional software design evaluation, witness developer tests, and perform other activities. Independent means independent of the software development organization. The earlier the IV&V personnel are involved, the better the structure of software T&E. For complex and sophisticated systems, the developmental and operational evaluators use the inputs provided by IV&V agencies to ensure that software is sufficiently mature. An IV&V agent may be either a government or contractor organization.

b. These organizations are identified and assigned early so that T&E planning is a smooth process that does not disrupt the program. It also gets the T&E personnel integrated into the project as part of the PM's program and acquisition team. This enables software T&E personnel to determine the extent to which data can be shared, and tests and evaluations combined. The software T&E team can better support the PM by:

(1) Sharing evaluations.
(2) Identifying deficiencies early.
(3) Providing alternative T&E strategies.
(4) Keeping the PM and decision-makers informed.

4-3. Working groups

Software T&E teamwork is enhanced through the effective use of working groups. These working groups are

established by the PM who is responsible for their activities and products. During mission need determination and concept exploration/definition phases, the PM establishes the test integration working group (TIWG). For AR 70-1 or Class I AR 25-3 systems a computer resources working group (CRWG) is also established. These working groups are discussed below.

a. TIWG.

(1) This is the primary test and evaluation team. It is formed to manage and plan the total T&E effort. The TIWG structures the T&E program for the system and the software, and integrates the varying test, evaluation, and data requirements.

(2) The structure of the TIWG and its principal members varies depending upon the type of system. Some systems use a CRWG to provide the software T&E support and input to the system TIWG. Other systems use only a TIWG to perform all T&E duties for the system.

(3) The principal members of the TIWG are the PM, independent evaluators (developmental and operational), independent testers (developmental and operational), user representatives, logisticians, post-deployment support personnel, and trainers. Associate members include the software quality assurance representative, development tester, and system engineer.

(4) Duties performed by the TIWG are:

(a) PM Chair - Prepares a charter and coordinates with principal members. The charter designates membership, duties, authority, procedures for settling disputes, and objectives of the TIWG.

(b) TIWG may charter other groups to provide input and support to the TIWG. For example, if the software/system is used by other services, a joint test and evaluation planning group provides input to the TIWG. For AR 70-1 systems, the CRWG provides the software T&E input to the TIWG and informs the TIWG of the software T&E status throughout the system life cycle.

(c) TIWG prepares the TEMP for the PM. The most effective method is to assign members responsibility for the parts of the TEMP. Parts I and II are prepared by the PM with role and responsibility inputs from the principal members. Part III is prepared by the developmental tester and the independent developmental evaluator and may include input from SQA, IV&V agent, and the software developer. Part IV is prepared by the independent operational tester and the independent operational evaluator. Part V requires input from all TIWG members to determine T&E resources (e.g., automated testing drivers, simulations models used, users to be involved in testing, etc.). The TEMP format is provided in Part Two of DA Pamphlet 73-1.

(d) TIWG handles all disputes, assists in allocation of T&E resources, determines where data can be collected to answer issues and criteria, and discusses evaluation and test events.

(5) It is the PM's responsibility to charter the TIWG. It is the responsibility of the principal members to ensure that it is an effective group.

b. CRWG.

(1) The CRWG is a working group used by AR 70-1 systems, to plan, monitor, and implement aspects of the computer resources for the PM. The CRWG is an integral part of the PM's acquisition team. It is established as soon as computer resources are determined to be part of the system. The PM is responsible for chartering and managing the CRWG.

(2) Membership of the CRWG includes the PM, user representatives, post-deployment support personnel (e.g. LCSEC), independent testers (developmental and operational), independent evaluators (developmental and operational), software quality assurance (product assurance), and other representatives as required.

(3) CRWG duties:

(a) Manages life cycle computer resources for the system.

(b) Prepares and updates the system's computer resources management plan (CRMP) throughout the life cycle. This document describes the management strategy for software development, testing, and life cycle support and is required IAW AR 70-1.

(c) Provides software and computer resources expertise to the TIWG.

(d) Provides input to the system TEMP through the TIWG.

(e) Reviews all requests for proposal (RFPs) to ensure that software T&E factors are addressed. A checklist of software T&E factors to be addressed is in Chapter 8 of this part of DA Pamphlet 73-1.

(f) Members can serve on the Source Selection Evaluation Boards (SSEB) (except the independent operational testers and operational evaluators). SSEB members review the bidders' responses and assess their capabilities to develop quality software.

(g) Monitors/participates in software development and T&E process.

(h) Provides a memorandum of agreement (MOA) to the TIWG. The MOA identifies the products, analyses, and T&E support to be provided by the CRWG.

(i) Updates the TIWG periodically with the status of software T&E, the impacts of software deficiencies, the readiness of software to support further T&E events, software T&E metrics and other related factors.

(4) An effective CRWG integrates the management of computer resources for the PM through the TIWG.

Chapter 5
Identification of Needs and Development of Concepts for System/Software T&E

Section I
Introduction

5-1. Overview
System needs are identified as operational mission requirements. These requirements are the result of an identified operational deficiency or the potential to increase productivity and efficiency within an organization or process. The processes of identifying the needs and evaluating, selecting, and documenting a system concept, which includes software, are areas in which T&E organizations, especially software T&E organizations, have had little impact. The needs identified at this time are not tested until development is complete and the end-item is the system. This chapter discusses two crucial phases of the system life cycle: mission need determination and concept exploration/definition. It discusses related software test and evaluation activities which occur during these phases.

Section II
Mission Need Determination

5-2. Early requirements documents
Needs are identified through a number of methods. Needs may be the natural outgrowth of studies and analyses of the military threat posed, a response to a requirement to perform a new mission, a response to improvements in technology, or a response to regulatory or doctrinal changes. Once the need is identified to the extent that operational users and the decision-makers create a proponency, the system is procured under either MSCR (AR 70) or AIS (AR 25) policy. T&E policy for any system is IAW AR 73-1.

a. **Mission needs statement (MNS).** The MNS is developed by the users' representative, functional proponent or combat developer (FP or CBTDEV). The MNS is the official starting point for the system life cycle. It documents the need identified by a threat study, an information requirements study, a fix to a deficiency identified during mission-area analysis, or a regulatory change.

b. T&E involvement during mission need determination. T&E involvement at this time deals with broad concepts which include factors such as:

(1) Types of operational testing necessary.

(2) Scope of testing required based upon the acquisition category.

(3) Identification of independent evaluators.

c. The critical operational test and evaluation issues and measures of effectiveness (MOE) to support the eventual MS III decision are developed and included in the TEMP as part of the documentation required for MS I. By necessity, these issues and MOE are based on the MNS and should reflect the system's ability to enable the user to satisfy the mission need. The issues and MOE are developed by the users' representative in coordination with the operational evaluator. They are approved at this time by the major command overseeing the work of the FP or CBTDEV.

Section III
Concept Exploration/Definition

5-3. Concept exploration/definition requirements documents and requirements engineering

As alternatives are eliminated during concept exploration, operational concepts and system requirements become better defined. Several activities occur in relation to the management aspects of the system at this phase of the life cycle. The requirements documents prepared by the user representatives further define the overall performance and characteristics at the system level. First, the documents driving the concept definition phase will be discussed, followed by a discussion of the T&E relationships and procedures.

a. Operational requirements document (ORD) (applies to AR 70-1 and Class I AR 25-3 systems only).

(1) The ORD is a bridge connecting the MNS to the acquisition program baseline and the specifications for the concept or system. At each milestone (MS) decision point (starting with MS I) the ORD reflects the current state of evolutionary requirements definition. It replaces the required operational capabilities (ROC).

(2) The user or user representative develops an ORD for the most promising system concept. At MS I, the ORD provides objectives and minimum acceptable requirements for performance capability parameters necessary to characterize the proposed system concept. These roll into the concept baseline and are used in the TEMP as thresholds.

(3) The ORD is used to develop requirements for the draft system specification.

(4) During this period, the evolving system definition and prototype experience causes updates and expansion of the ORD. The user or user representative updates the ORD to include objectives and minimum acceptable requirements for those performance capability and performance characteristic parameters that characterize the proposed system design approach. The target date for achieving operational capability

should also be identified along with a final list of critical system characteristics. It will be used to develop requirements for the system and development specifications. The ability of the system to satisfy performance requirements described in these specifications will be verified by development test and evaluation and engineering design analyses.

(5) The minimum acceptable operational performance specified in the ORD is used to refine test criteria for operational test and evaluation. The issues and MOE must remain mission focused. Operational test and evaluation will also provide data to characterize actual system performance capabilities in the intended operational environment.

(6) After MS II, the ORD should only be modified as a result of a change in the MNS or cost-schedule-performance trade-offs during development.

b. Users' Functional Description (UFD).

(1) The user representative (CBTDEV, FP or PA) prepares a UFD to bridge the high-level system initiation documents (MNS, ORD) to the detailed system specifications. The UFD provides information to communicate the operational requirements for automated processing/computer resource capabilities within the system. All AIS projects have a UFD. AR 70-series systems with automated processing capabilities also have a UFD. The format for writing a UFD is contained in DA Pamphlet XX-XX, "Operational Requirements for Automated Capabilities."

(2) The UFD defines the operational requirements of systems in sufficient detail to guide the software development. The UFD describes implications of the operational requirements for automated capabilities on the system's operational modes and mission profile, proposed procedures, interfaces with other systems, and degraded operations. It amplifies information about the system's environment as it impacts the system's automated processes.

(3) System requirements are frequently divided into blocks which represent levels of performance or functionality. These blocks may form incremental releases which lead to the final full-up system. Blocked user requirements must be clearly defined and documented to ensure adequate T&E for releases or formal testing for production decisions.

(4) The UFD can be in draft form during mission need determination and concept exploration/definition. It is expected that the UFD is a dynamic document during early stages where there are many unknowns. This means that it can be updated as frequently as necessary in response to prototyped versions and other demonstrations. As the unknowns are understood, the UFD should become less volatile.

(5) The UFD should be baselined and approved for AIS 25-series systems by AIS MS I. For block developments, each block should be approved by MS I for AIS. The UFD for AR 70-series systems should be baselined and approved by MSCR MS II.

c. Requirements engineering.

(1) The user representatives use concept exploration/definition and demonstration/validation phases to continually refine the software requirements. Varying methods may be applied to achieve this. Examples are rapid prototyping and user demonstrations of requirements. These methods give users the chance to see pieces of the system early and make changes <u>before</u> system design begins.

(2) User demonstrations are useful (and encouraged) to show the user concepts of how the requirements might be implemented through software. The better the user expresses those needs in requirements, the easier the developer can design the system. This also assists the T&E community to plan and focus T&E efforts. Early user demonstrations provide the opportunity to check and refine requirements.

5-4. Concept exploration/definition T&E documents
At key milestones in the acquisition process, decision-makers must decide whether a system will proceed into the next phase of acquisition. At these designated milestones, developmental and operational evaluators are required to prepare and present assessment reports to the decision-makers. If there is no IV&V agent appointed for the acquisition and development, the PM will report that fact to the decision-makers. A justification for not using IV&V agents during software development will be required. For cases where no IV&V agent is used, the developmental and operational evaluators will prepare additional reports regarding software development, design, and traceability to the user's requirements.

a. Critical operational issues and criteria (COIC). The COICs are prepared by the user representatives and coordinated with the independent operational evaluator IAW Part Three of DA Pamphlet 73-1. Issues take the form of questions, the answers to which permit an evaluation of the overall operational effectiveness and suitability of the system (software). Criteria are thresholds against which issues are evaluated. These critical issues and criteria, once approved, are documented in Part IV of the system's TEMP. COICs are approved by either Deputy Chief of Staff Operations and Plans (DCSOPS) or Director of Information Systems Command, Control, Communications and Computers (DISC4) prior to MS II for all systems managed at or above the ASARC or MAISRC levels. There is no separate set of

COICs for software. Issues and criteria are developed to meet the following general objectives:

(1) Comprehensiveness -- ensure that all concerns which impact the operational use of a system are addressed and ensure that the users can satisfactorily accomplish the critical mission functions without any undue burden.

(2) Realism -- ensure that system operational characteristics contained in the requirements documents are translated into user criteria that address operational effectiveness and suitability.

(3) Progressiveness -- ensure that the criteria recognize, where appropriate, that the development process builds on technical and operational learning.

b. A TEMP is required for systems under development. An approved TEMP is required by Milestone I and includes system requirements stated in the ORD or MNS. TEMPs for systems after Milestone III are as required IAW AR 73-1.

(1) The TEMP identifies the T&E organizations and responsibilities, strategy, and milestone schedule for the system. The TEMP also identifies issues and criteria for evaluating the system and may include the use of metrics as described in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1. The level of completeness for the technical issues and criteria also referred to as technical parameters, will not vary with the maturity of the system as it moves through its life cycle process. Satisfaction of operational characteristics based on the ORD and UFD can be demonstrated in technical tests or in early or limited user tests. These demonstrations of user functional capabilities serve the program sponsor as a measure of progress toward satisfying the mission need in the IOT required for a successful MS III. Development issues and criteria can be satisfied through a variety of sources, not only test events. Other sources might include models, simulation, surveys, studies or other means. The TEMP format is provided in Part Two of DA Pamphlet 73-1.

(2) If the accelerated development/fielding acquisition approach is to be used, the sets of critical mission functions comprising each software block are identified as part of the critical technical parameters. The critical mission functions/blocks needed to provide a minimum useful operational capability are identified as the representative sample. The representative sample is the first aggregate of blocks suitable for fielding to users after it is operationally tested.

c. Independent evaluation plan (IEP)/independent assessment plan (IAP) and test design plan (TDP). The Government developmental IEP/IAP and the TDP are drafted during the concept exploration/definition

phase. The formats for these plans are tailored as required, but the general content and format are found in Part Four of DA Pamphlet 73-1 regarding developmental test and evaluation.

d. Test and evaluation plan (TEP). Operational tests and independent operational evaluations use the TEP for system and software evaluation. The TEP describes the strategy for testing and evaluating the system COICs. Additional operational issues and criteria may be included as well. The TEP format can be found in Part Five of DA Pamphlet 73-1.

e. Acquisition decisions for developmental and non-developmental programs are heavily influenced by the analysis and evaluation of data associated with issues and criteria. Approved issues and criteria are used to determine the scope, emphasis and intensity of the T&E effort. This determination is the basis for the resources that must be committed to obtain the data to answer the issues and evaluate the degree to which criteria are met. The PM and T&E community are responsible for ensuring that the required resources are programmed, budgeted, and available.

f. Technical issues and criteria (reference Part Four of DA Pamphlet 73-1) are developed by the developmental evaluator and relate to critical technical characteristics or parameters of system performance, reliability, maintainability, software functions and features, communications, technological attributes, as examples. Critical technical system issues are stated in the developmental IEP or IAP (reference Part Four of DA Pamphlet 73-1), and described or summarized in Part III of the TEMP.

5-5. T&E resourcing for operational testing

a. Operational test and evaluation funding. Part V of the TEMP provides a summary of all key resources, both Government and contractor planned, to be used during the course of the acquisition program. The initial TEMP projects those key resources necessary to accomplish developmental test and evaluation (DT&E) and operational test and evaluation (OT&E) objectives, including contractor or government test beds, test drivers (simulators or stimulators), major range and unique instrumentation requirements, threat simulators, and targets.

b. Outline test plan (OTP).

(1) The OTP provides detailed information on resources required to support Part IV of the TEMP. Evaluation plans and test plans integrate test requirements and provide the audit trail for validation of resource requirements. The OTP is the basis for programming and budgeting for tests requiring user troops. The OTP, as the tasking document, is usually revised and updated based on test requirements when the

TEP and test plans have been written. The documents are compared and trade-offs between test requirements and available resources are discussed. The result is coordinated documents which meet test objectives and consume minimum resources. The OTP, as updated, establishes the scope and resource ceilings within which testing will be conducted.

(2) Test schedule and review committee (TSARC). The TSARC, using information from OTPs, provides high-level, centralized Army management of resources (i.e., personnel, equipment, funding, flying hours, ammunition and instrumentation) for operational test and evaluation. The TEMP is reviewed by the TSARC to ensure that resource requirement updates are accommodated in the OTP.

(3) The OTP is the principal resource management document used by the TSARC for operational testing. All direct costs for operational testing are delineated in an OTP. It lists the necessary resources and the administrative requirements to support an operational test and evaluation (AR 15-38) as well as the associated suspense dates and test milestones. When included in the approved five-year test plan (FYTP), an OTP becomes a formal resource tasking document for test execution and resource allocation within program and budget constraints. These constraints are in accordance with priorities for tests scheduled in the current and budget years. Refer to Part Four of DA Pamphlet 73-1 for OTP descriptions and procedures.

5-6. Evaluations during the concept exploration/ definition phase

During concept definition the software T&E community performs evaluations in specialized areas related to software. The software T&E community will be heavily involved in reviewing the system-level statement of requirements which is one of the primary outputs of the concept definition period. There are three types of evaluations discussed here: (1) continuous evaluation performed by any organization, (2) independent developmental evaluations/assessments, and (3) independent operational evaluations performed by specially assigned organizations. All of these evaluations provide input to the PM and decision-makers.

a. Continuous evaluation. Evaluation is performed by the software T&E community for the PM and decision-makers. Various agencies provide this information during the concept definition phase. The level of technical software evaluation varies with the extent of concept definition performed. Continuous evaluation takes many forms during the system concept definition. It is important for the software T&E community to be flexible and provide the level of evaluation support

necessary to move from concept phase into other phases, as well as provide the required information for decision-makers at designated milestones. During concept definition, the software T&E community participates in the technical evaluation of the system and its ability to support operational doctrine and concept. Early operational assessments (EOAs) are provided to the program sponsor and decision-makers during this phase. The scope of the software T&E community involvement depends upon the approach used in concept definition and the acquisition strategy. System concepts which are well-defined and concept risks that are low may lead to less activity during this phase. System concepts which are to be prototyped, advanced developed, alternatives to be analyzed, benchmarked, and fly-offs or run-offs between differing concepts demand more activity from the software T&E community. If software developments occur during concept exploration/definition and this development is intended to be carried over into the design and development of the actual system, then the software T&E community will be heavily involved in this phase. Furthermore, the formal documentation requirements, design reviews, and software testing are required to be performed for the software to be supportable and carried over into the next phase. If software is developed/prototyped and used only to demonstrate the concept and thrown away, the software T&E involvement and types of evaluation are less formalized.

(1) Documentation. The primary software and system requirements documents are usually in the form of a UFD, draft sections of the functional description (FD), or the draft system level specification, sometimes called the system/segment specification (SSS) or A-specification. These require thorough review and evaluation.

(2) Review Factors. The software T&E community reviews the system requirements documentation as follows:

(a) Determines if the requirements as specified can be tested, and if the requirements have measurable criteria.

(b) Determines if the user requirements (ORD, MNS, UFD, etc.) trace to the statement of system requirements. This is normally an IV&V function performed for the PM.

(c) Determines if the system characteristics, system performance, peak loading, message formats, system interfaces (e.g., identifying interfaces, other systems for interoperability) are feasible.

(d) Determines if the requirements stated in the various levels of documents are consistent with one another.

(e) An overall review of the UFD and/or system-level specification must also include the review of trade-offs and risks associated with the allocation of requirements, and review the trade-offs for potential operational, technical, or T&E impacts. Operational and developmental evaluators also review the capability of the system to meet the technical requirements and operational missions.

(3) If the acquisition strategy calls for an accelerated software development, it may be necessary to conduct more stringent evaluations and tracking as described in Chapters 6 and 7 of this part of DA Pamphlet 73-1. The extent of these evaluations, including the use of metrics, are dependent upon the degree to which the software is carried over in future system phases and the delivery requirements of the statement of work (SOW).

(4) SOW reviews. The software T&E community provides input and review of in-house work directives, RFPs, SOWs, and other work tasks relating to software development and T&E. Depending upon the type of contracting or the type of in-house work directive, software T&E personnel (except operational testers and operational evaluators) may participate in SSEBs through the CRWG or through the TIWG. A checklist for reviewing these documents and sample contract clauses are provided in Appendix B, Statement of Work, of this part of DA Pamphlet 73-1.

(5) Benefits to SOW reviews. The long-term importance of this activity and its impact on software T&E is usually not addressed until there is a problem in the contract or the in-house work directive. It is imperative to ensure that contract deliverables are clearly stated and timed to ensure useful information is received when needed. As an example, all open software problem reports must be available prior to the start of Government testing. The T&E people review the SOW and in-house work directives to make sure that the following issues are addressed: software design reviews; collection or delivery of metrics; delivery of software problem reports from the developers; hooks, ports, etc. to instrument for test data collection purposes; and delivery of T&E or other software documentation.

b. Independent developmental evaluations/ assessments.

(1) Independent developmental evaluations/ assessments are accomplished by assigned organizations IAW AR 73-1 at critical acquisition stages. These evaluations address:

(a) Basic engineering/mathematical assessments of test results,

(b) System performance,

(c) System reliability, availability, and maintainability (RAM),

(d) Integrated logistic support (ILS),

(e) Manpower and personnel integration (MANPRINT) issues, including human factors engineering (HFE) (e.g., user-friendliness, workloading), and system safety.

(f) Implementation of metrics as defined in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

(2) These evaluations/assessments of systems containing software can take the form of paper analyses or a complete concept evaluation providing formalized documentation and formalized events for evaluation such as design reviews and actual test events.

(3) Independent developmental evaluations/ assessments performed during concept definition are structured to answer or partially answer specific high-risk issues and criteria. These are issues which have been identified as technically risky due to use of emerging technology, requirements for real-time processing that push state-of-the-art capabilities, requirements for innovative interactive interfaces, application of artificial intelligence (AI) techniques to information processing, or the application of an existing technology to a new area.

c. Independent operational evaluations and operational testing. Independent operational evaluations are performed by specially assigned organizations IAW AR 73-1 during the concept definition process and throughout the life cycle. During concept definition an EOA is prepared IAW DA Pamphlet 73-1 Part Five, which relies heavily upon technical data. It also focuses on mission performance, operational employment, and issues of suitability of the concepts. The EOA is planned in conjunction with an abbreviated TEP and answers, in full or in part, some set of issues and criteria. The EOA will form the basis of the report to the decision makers for the next milestone decision. It may be in the form of a strictly paper analysis or it may be the result of early concept testing on advanced development models, prototypes or several competing concepts.

(1) Early operational evaluation. Results from early user testing or other operational tests are evaluated and reported in the EOA. The EOA specifically addresses software from two perspectives:

(a) Is the software being designed with the user in mind? Can the user interface effectively with the software and consistently control it so that the required system functions are provided?

(b) Is the software "on-track" with respect to planned state of development? In particular, are there any indications that the software will not be

ready to support the objectives of further operational testing?

(2) In addition, problems experienced with the software and observations about the utility of developed test tools may be reported. The version of the software which was tested is described along with the significance of any deviations from the software to be fielded.

(3) Operational testing. Operational testing at this phase may be suggested by the user representatives. Early in concept formulation, operational tests may take the form of Early User Test and Experimentation (EUTE), Limited User Test (LUT), or Force Development Test and Experimentation (FDTE) as described in AR 73-1. Results of these tests are used to evaluate the proposed concept(s), refine user requirements, provide input for concept selection, provide input for milestone decisions and assist in refining tactics, doctrine or standard operating procedures (SOP). Detailed explanation of these test types are in DA Pamphlet 73-1, Part Five.

(4) Evaluation reporting. Evaluations provide formal scheduled assessments of the system's and software's operational effectiveness and suitability to decision-makers at milestone decision reviews and provide periodic, ad-hoc status reports whenever changes occur in the status of the evaluation. Independent evaluations are produced in the following three forms. They are described in detail in Part Five of DA Pamphlet 73-1:

(a) Independent evaluation briefings (IEB) to milestone decision reviews.

(b) Formal test and evaluation reports (TERs).

(c) Operational assessments (OA, EOA, AOA).

(5) Operational assessments. The OA is an abbreviated, less formal report of independent operational findings. The OA must be compatible with the IEB. An OA may be an <u>early</u> OA (EOA), i.e., prior to MS II, or an <u>abbreviated</u> OA (AOA), which is produced instead of an TER when scheduling, testing limitations, decision-maker requirements, or other factors preclude a comprehensive operational evaluation. In this case the operational testing accomplished is typically FDTE, EUTE, concept evaluation, or similar developmental test event.

(6) Independent evaluation briefing. Formal IEBs are presented to the decision bodies by the operational evaluator at each major decision milestone. The briefing summarizes the evaluation (OA or TER) submitted prior to the Defense Acquisition Board (DAB), Army Systems Acquisition Review Council (ASARC), In-Process Review (IPR) Panel, or Major Automated Information System Review Council (MAISRC), and

contributes to management decisions by the review body. The format for an IEB is provided in Part Five of DA Pamphlet 73-1. Most often, the independent operational evaluator presents the key technical findings of the developmental evaluation along with the operational evaluation.

5-7. Metrics during mission need determination and concept exploration/definition

The metrics with a check mark apply at this time:

✓ Cost	Reqts Traceability	Breadth of Testing
✓ Schedule	Reqts Stability	Depth of Testing
CRU	Design Stability	Fault Profiles
SEE	Complexity	Reliability

a. Collection of data for the cost and schedule metrics is started. The metrics are examined for adherence to allocated budgets and planned events.

b. Preliminary traces of user and system requirements begin. These traces include MNS/ORD to UFD and UFD to draft FD or SSS. For systems undergoing operational testing in these early phases, requirements will likely be more comprehensive and the traces more complete. In this case, acceptable degrees of requirements traceability and stability may be appropriate as exit objectives.

5-8. Decision criteria

a. The outputs from the two phases described in this chapter must provide the basis for software design, development, software T&E, and ultimately system T&E. Refer to Table 5-1 for decision criteria.

b. Decisions to move into the system design and software design phases are the results of milestone reviews. A positive milestone review results in the commitment by the Army to move forward with the selected concept design and to develop the system and software.

Table 5-1. Mission Need Determination and Concept Exploration/Definition Products

Primary Responsibility	Products	Decision Criteria
User Representative (e.g., CBTDEV, FP, PA)	Critical Operational Issues & Criteria (COIC)	Approved
	Mission Needs Statement (MNS)	Approved
	Operational Requirements Document (ORD)	Approved
	Users' Functional Description (UFD)	Drafted
PM and TIWG	Test & Evaluation Master Plan (TEMP)	Approved
PM and CRWG * (AR 70-1 systems only)	Computer Resource Management Plan (CRMP) *	Drafted
PM and Materiel Developer	System/Segment Spec. (SSS) or Functional Description (FD)	Drafted
Independent Developmental Evaluator or Assessor	Critical Technical Character./Parameters	Included in approved TEMP
	Critical Technical Issues and Criteria	Drafted in IEP or IAP
	IER/IAR *	Completed IER/IAR for milestone reviews
Independent Operational Evaluator	Additional Operational Issues & Criteria (AOIC)	Drafted in TEP
	EOA, OA, TER, IEB *	Completed for milestone reviews
Independent Operational Evaluator and Operational Tester	Test and Evaluation Plan (TEP)	Draft TEP
	Abbreviated TEP *	Completed
Operational Tester	FDTE, EUTE, LUT *	Completed Test Report
System or Software Developer, Independent Evaluator	Requirements Trace(s)	Drafted
	Metrics Report(s)	Acceptable degrees of: requirements traceability and stability

* Program dependent

Chapter 6
Software T&E Activities in Relation to Software Requirements Definition and Design

Section I
Introduction to Definition and Design Activities

6-1. Introduction

a. Test and evaluation activities discussed in this chapter are designed to be flexible to accommodate various acquisition strategies. The design activities performed during preliminary and detailed design activities may be cyclic. Sometimes designs of parts of the software are simpler to detail and engineer than others. This process allows for repetitions of preliminary and detailed design activities for as many cycles as necessary. These procedures provide the flexibility to move forward for those design pieces which are ready and meet the criteria for the next phase.

b. The user representatives need to participate in these activities. User participation will ensure that the software evolves to support the system mission. User demonstrations of capability, walk-throughs of the user-machine interfaces, and participation in the cyclic design reviews are examples of necessary user participation.

c. This chapter describes software T&E support activities which are performed for continuous evaluation purposes for the PM. These activities are designed to reduce risks and provide the PM with information to make informed decisions. The PM controls these phases in the process and uses software T&E inputs to assist in disciplining and managing the process.

d. Reviews are conducted to assess the readiness of the concepts and designs to move from one level of detail to the next. The scope of the reviews depends upon acquisition type, system complexity, and the PM or MATDEV's needs. Reviews are conducted by the PM or MATDEV and matrix support.

e. If there is no IV&V agent assigned to the program, the developmental and operational evaluators may
be required to prepare and present assessment reports at the CDR and walk-throughs.

f. Decision criteria discussed in this chapter are used as standards applied to decision-making. Moving from one phase to the next is a decision process executed by the PM or MATDEV, who uses this information to assess system status and determine the risk associated with progressing to the next phase.

Section II
Systems Requirements Analysis

6-2. System requirements analysis phase

a. RFPs, SOWs and in-house work directives, top-level documentation of the system requirements concept in the UFD, FD or SSS aid in selecting the software developer. Developers may be in-house or may be contractors.

b. The set of activities in which the software T&E community participates is a series of working-level reviews of the higher system-level requirements. These requirements are decomposed and allocated by the developer to more detailed functions and features to support the overall system concept.

6-3. T&E activities - systems requirements analysis

a. System requirements analysis is the responsibility of the PM and developer. It is used to determine whether preliminary requirements allocated to software (SW) and hardware (HW) make sense. Incremental reviews with the developer using informal (action officer level) methods (e.g., requirements walk-throughs) ensure that requirements in the MNS, ORD, UFD, FD or SSS are understood and addressed. Software developers, and IV&V agents should begin/continue implementing the requirements traceability metric as defined in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

b. Continuous evaluation activities are performed to assess the requirements and provide an information base for evaluation and future test events. The program sponsor reviews the system requirements, as follows, with the software T&E community providing support to items (2), (3), (6), (8) and (9):

(1) Determines if the requirements provide a base for developing system-level design.

(2) Determines if the requirements in the FD, UFD or SSS have their base in the mission needs MNS or ORD; also determines whether the requirements are satisfied in the FD or SSS by performing requirements traces.

(3) Determines consistency, in terms of formats, protocols, etc., through review of initial interface and/or interoperability requirements.

(4) Assesses the adequacy of the stated requirements to support software development.

(5) Ensures that the stated design will achieve performance goals through modeling and simulation activities.

(6) Determines if the requirements are complete, unambiguous, comply with stated standards, and are testable and feasible.

(7) Determines compliance with DOD higher order language (HOL) policy. Ada is the designated HOL.

(8) Reviews security requirements.

(9) Reviews post-deployment support alternatives for operational and support concepts.

6-4. Metrics during system requirements analysis
The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	Breadth of Testing
✓ Schedule	✓ Reqts Stability	Depth of Testing
CRU	Design Stability	Fault Profiles
SEE	Complexity	Reliability

a. Cost and schedule metrics are examined for adherence to allocated budgets and planned events.

b. As requirements traces are updated to reflect evolving requirements, traceability and stability of high level system functions can be assessed.

6-5. System requirements review and decision criteria
The culmination of these activities is a formalized system requirements review (SRR). The review logically is a wrap-up of the informal walk-throughs conducted at the action officer level. These reviews address issues stated in MIL-STD-1521B and other program relevant issues.

a. Decision criteria (see Table 6-1) for the SRR need to be considered carefully by the PM in preparation for entering the system design phase. The SRR constitutes a review of mission and requirements analyses, developer's interpretation of requirements (e.g., FD, SSS, ORD), functional flows, requirements allocation, trade-offs, system interfaces, initial test planning, technical performance measures planning, post-deployment support concepts, and fielding plans.

b. The SRR is performed by the PM, supported by the developer, and other support groups. Participants in the reviews (e.g., IV&V agent, user representatives, SQA, etc.) need to provide feedback to the PM in the form of results from informal walk-throughs, system requirements issues and their impacts. This feedback is part of an overall systems engineering principle to ensure that deficiencies are addressed early, risks noted and decisions made.

c. Decisions to move to the next phase need to consider that the documents, evaluations, degree of requirements traceability, and reviews show that these items are ready to support the next phase in design/ development.

Table 6-1. System Requirements Analysis

Primary Responsibility	Products	Decision Criteria
User Representative and MATDEV	Users' Functional Description (UFD)	Final
PM and MATDEV	System/Segment Spec. (SSS) or Functional Description (FD)	Updated draft
	System/Subsystem Specification (SS)	Drafted
PM and Developer	Configuration Management Plan	Drafted
		SRR Conducted
System or Software Developer, SQA, IV&V and Independent Evaluator	Requirements Trace(s)	Updated
	Metrics Report(s)	Acceptable degrees of system requirements stability and traceability

Section III
System Design

6-6. System design activities

a. System design is the responsibility of the system developer. The system design provides the engineering solution to the system requirements.

b. Continuous evaluation activities performed during system design concentrate on the evolving system documentation. These activities provide an information base for evaluation and future test events and consist of the following:

(1) Review the system design documents (SSS, FD, SS, draft SRS, US, IRS, DS) for the following:

(a) System design provides growth capability.

(b) System design traces back to the system requirements.

(c) System design addresses interoperability requirements (if applicable).

(d) Review provides user-machine interfaces trace to user-defined requirements.

(2) Review developer's software quality assurance program to determine developer's internal evaluation mechanisms.

(3) Review developer's proposed software schedules to provide feedback regarding compliance with required milestones.

(4) Implementation of applicable metrics.

(5) Review use of NDI software in the design considering percent of modification, availability of documentation, and testability issues.

(6) Review use of software development tools for capability to accomplish a quality design.

c. Results of continuous evaluation assessments are provided to the PM for tracking system design status.

d. The formal end of this activity is the system design review (SDR). This review should be a roll-up of the design addressed informally during the walk-throughs. The outcome of the system design is a functional baseline and the overall system concept is completed.

6-7. Metrics during system design

The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	Breadth of Testing
✓ Schedule	✓ Reqts Stability	Depth of Testing
✓ CRU	Design Stability	Fault Profiles
✓ SEE	Complexity	Reliability

a. Initial processor, memory and I/O utilization budgets should be available at this time.

b. The SEE metric applies as one of the factors in evaluating software contractors if one or more vendors are to be selected at this time.

6-8. System design review and decision criteria

Decision criteria for this phase are shown in Table 6-2.

a. The SDR is performed by the PM, supported by the developer, and other support groups. Participants in the reviews (e.g., IV&V agent, user representatives, SQA, etc.) need to provide feedback to the PM in the form of results of informal walk-throughs, system requirements issues and their impacts. This feedback is part of an overall systems engineering principle to ensure that deficiencies are addressed early, risks noted and decisions made. To be considered successful, the SDR will include reviews of completed SSS or completed FD sections, and draft software requirements specifications (e.g., SSR, IRS, SS, database specifications (DS), unit specifications (US)). The SDR will include reviews of traceability from the system level specifications back to the UFD, MNS or ORD, and traceability from the system specifications into the draft software specifications. At this point the functional baseline for the system is established and placed under configuration control.

b. The results of the requirements traceability, requirements stability should be presented at the SDR. The requirements should show an acceptable degree of completeness, traceability (SSS to SRS and IRS, FD to

Table 6-2. System Design

Primary Responsibility	Products	Decision Criteria
Developer and PM	SSS	Final SSS
	SRS, SS, US	Draft SRS, SS, US
	IRS, DS	Draft IRS, DS
	Software Development Plan (SDP)	Approved SDP
	Software Quality Program Plan (SQPP)	Approved SQPP
	Configuration Management Plan	Approved CM Plan
		SDR conducted
		Functional baseline established
S/W Developer and Gov't. SQA or IV&V	Requirements Trace(s)	Updated
	Metrics Report(s)	Acceptable degrees of requirements traceability and stability

SS), and stability (SSS and SS/FD). Preliminary CRU allocations to computer software configuration items (CSCIs) should be compliant with the contract and higher-level specifications.

c. Before moving to the next phase, the documents, evaluations, metrics indicators, and review should show that these items are ready to support the next phase in design/development or risks are identified.

Section IV
Software Specification/Requirements Analysis

6-9. Software specification/requirements analysis activities

a. The software requirements evolve from the approved system design. The software requirements/specifications are documented in software requirements specifications (SRS), IRS, or DS, US, and SS.

b. Continuous evaluation activities performed within the T&E community need to include user representatives. Activities performed are:

(1) In-depth software requirements reviews of SRS, IRS or DS, US, SS for testability, performance, timing and interfaces.

(2) Tracing from software requirements back up to system requirements. The combat developer or functional proponent participates in the requirements trace to ensure that the users' requirements have been properly interpreted by the software specification writers. -

(3) Review of user-machine interfaces for simplicity, logical sequencing, and tracing back to user-defined requirements.

(4) Implementation of applicable metrics.

c. The configuration management function supports the test and evaluation efforts by placing the set of qualification requirements for each software item under control. The qualification requirements are normally documented in the set of development specifications, subject to evaluation for adequacy of test coverage and testability, such as the SRS, IRS, or SS. The configuration management function may also conduct SSRs of these documents prior to authentication. After authentication of the set of software-related development specifications (which are entered into the allocated baseline) all changes to these documents are processed as engineering change proposals (ECPs), reviewed by the Army Program/Project Office Configuration Control Board (CCB), and approved by the CCB chairman.

6-10. Metrics during software specification/requirements analysis

The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	Breadth of Testing
✓ Schedule	✓ Reqts Stability	Depth of Testing
✓ CRU	Design Stability	Fault Profiles
✓ SEE	Complexity	Reliability

a. The SEE metric applies as one of the factors in evaluating the capabilities of various software contractors.

b. Additional information on metrics as applied in this phase can be found in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

6-11. Software specification/requirements analysis decision criteria

Decision criteria for this phase are shown in Table 6-3.

a. The formal culmination of these activities is a series of software specification reviews (SSRs). As previously stated, the preferred methodology is to use a series of incremental and informal walk-throughs and reviews to work through the information of the software requirements. This is particularly crucial if requirements are still evolving and incremental

Table 6-3. Software Specification/Requirements Analysis

Primary Responsibility	Products	Decision Criteria
Developer & PM	SRS, US IRS, DS Test Plans	Final SRS, US Final IRS, DS Draft Test Plans (software test plans) SSR(s) conducted Allocated baseline established
Oper. Tester & Independent Oper. Evaluator	TEP	Draft TEP
Devel. Tester & Independent Devel. Evaluator	IEP/IAP	Updated
PM/SW Developer, Gov't SQA or IV&V, and users' representative	Requirements Trace(s) Metrics Report(s)	Updated Acceptable degrees of: requirements traceability and stability; CRU allocations

development occurs.

b. The SSRs are performed by the PM, supported by the developer, and other support groups. Participants in the reviews (e.g., IV&V agent, user representatives, SQA, etc.) need to provide feedback to the PM in the form of results of informal walk-throughs, system requirements issues and their impacts. This feedback is part of an overall systems engineering discipline to ensure that deficiencies are addressed early, risks noted and decisions made.

c. Decisions to move to the next phase need to consider that the documents, evaluations, metrics indicators, and review show that these items are ready to support the next phase in design/development.

d. The results of the requirements traceability, requirements stability, and CRU metrics should be presented at the SSR. The requirements should show an acceptable degree of completeness, traceability, and stability. The design typically would show some volatility and fluctuation at this time. CRU allocations to CSCIs/programs should be compliant with the contract and higher level specifications. If

requirements show volatility or if traceability problems exist, it may be premature to move to preliminary design.

Section V
Preliminary Design Phase

6-12. Introduction
The preliminary design phase can be described simply as the developer's efforts to further allocate the allocated baseline software requirements to a preliminary software design. Allocation during this phase is the effort to better define (to a lower level of detail) the functionality of the software, so that eventually it can be reduced to logic flows and source code in later design/development phases. What results is a well-defined high-level design architecture, and when determined to be mature, a preliminary design review (PDR) is held to evaluate and approve the early design prior to proceeding to the next phase. It is important to note that full maturity is not necessary to get approval at PDR, since the developer is allowed to have the flexibility to refine and optimize the design. However, the allocated baseline must be mature enough to allow for an intelligent decision to proceed forward -- this is very important both in minimizing program cost and schedule risks, and in improving the overall quality of the design. For complex systems, the PDR may require a series of iterative reviews as the design progresses and matures.

6-13. Preliminary design activities
a. There are three primary objectives which must be achieved during preliminary design. Objective one requires the demonstration of the compatibility between the allocated baselined software requirements and the proposed preliminary software design. The primary method to verify this objective is through an assessment of the traceability of the software requirements down to the proposed preliminary software design. Both the US and DS or the software design document (SDD Part I) are utilized to document preliminary software designs for Army systems. A traceability assessment should demonstrate that all software requirements have been allocated to the proposed preliminary software design. This traceability assessment should also ensure that no extraneous design has been introduced which cannot be traced back to the baselined software requirements. This traceability assessment should include traceability of interface requirements defined in the IRS or FD and SS.

b. Objective two requires the demonstration of the technical adequacy of the proposed preliminary software

design. The primary method to verify this objective is through an assessment of the capability of each preliminary design function/component to perform the applicable software requirements. The DS, US or SDD Part I represents the preliminary software design. An assessment of each function/component should examine what the software is supposed to do as stated by the software requirements and how the software will perform those requirements as described in the contents of the US, DS or SDD Part I. An assessment of this type provides insight into the technical adequacy of the proposed preliminary software design.

c. Objective three calls for the presentation of the proposed software test plans and, if applicable, the proposed user's manual. Test plans are defined and these documents identify the specific methods which will be utilized to test all levels of the software system. An assessment should be made to determine if the proposed test plan can provide testing which will produce the information needed to evaluate software performance and validate software requirements. The proposed test plan should be an explicit document which adequately addresses all aspects of software testing, including stress testing, interface testing, regression testing, and built-in test validation.

d. Continuous evaluation activities during preliminary design will provide reports and information to the PM. The objectives for preliminary design will be assessed and reported by SQA, IV&V and other participants in CE. The implementation and evaluation of applicable metrics are part of CE.

e. The user representatives need to participate in the reviews. Preliminary design emulations, rapid prototyping or similar methods can be used to demonstrate the early designs to the user.

f. The configuration management function supports the test and evaluation efforts by identifying and controlling the test planning documents and test requirements. The configuration management function also establishes a developmental configuration that stores and controls elements of the preliminary design after evaluation. In this activity, the preliminary design and structure of each CSCI/program/subsystem are developed, in terms of computer software components (CSCs)/modules or software units. The software engineering activities are supported by (a set of) PDRs. The essential engineering efforts and decisions generated during this process are normally documented in preliminary versions of the SDD, IDD, or US and DS. Even though not an element of the configuration identification, the contracting activity approved STP is also placed under the contractor's internal change control. This internal control of the contractor's STP is necessary to ensure that the scope of the software

test program will be implemented as mutually agreed between the Government and the contractor. In addition to the formal configuration baselines (functional, allocated and product), the software development contractor initiates internal control over the evolving software design and code, termed the developmental configuration, for each item of software. This internal "baseline" bridges the gap between the software portions of the allocated and product baselines.

6-14. Metrics during preliminary design
The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	Breadth of Testing
✓ Schedule	✓ Reqts Stability	Depth of Testing
✓ CRU	✓ Design Stability	Fault Profiles
✓ SEE	✓ Complexity	Reliability

a. Initial data as a foundation for the design stability and complexity metrics become available at this time. More detailed information should be available for existing NDI software that is to be modified.

b. The SEE metric applies as one of the factors in evaluating the capabilities of various software contractors.

c. Additional information on metrics as applied in this phase can be found in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

6-15. PDR conduct and decision criteria
Decision criteria for this phase are shown in Table 6-4.

a. Depending on the complexity of the software system, the PDR may be presented as an interactive process allowing the PDR participants lead times to address large amounts of information. For more complex systems, several PDRs may be held in an iterative fashion to allow design to progress. Regardless of the method of conduct, a PDR should be considered successfully complete only after all responsible organizations have presented their assessment of adequacy, and only if the proposed preliminary software design, the proposed interface design document and the proposed software test plans are approved by the PM with concurrence from the PDR participants.

b. The PDR needs to be a realistic review. The overall objective is to provide the PM with enough information to make an informed decision. It is imperative that information be shared between the software T&E community as well as the PM. Active participation in the form of presentations by the user, software engineering, and software quality assurance

Table 6-4. Preliminary Design Phase

Primary Responsibility	Products	Decision Criteria
Developer and PM	Develop Preliminary Design	Program design language (PDL) for top level design User demonstrations PDR(s) conducted
S/W Developer, Gov't SQA or IV&V, and users' representative	Requirements Trace(s) Metrics Report(s)	Updated Acceptable degrees of: requirements traceability and stability; CRU allocations; design stability; complexity

(and others) is essential in achieving the PDR objectives. These presentations should include results from the continuous evaluations conducted to date. The PM must be presented with all of the facts and perspectives in order to assess:

(1) The compatibility between the allocated baselined software requirements and the proposed preliminary software design.

(2) The technical adequacy of the proposed preliminary software design (SDD Part I).

(3) The adequacy of the software test plan.

(4) Current metrics and other results from the continuous evaluations.

c. A successful PDR provides several benefits to the software T&E community. The major benefit is the knowledge that the proposed preliminary software design will adequately address the baselined software requirements. Additionally, a successful PDR provides the knowledge that the proposed software test plan will provide testing which will allow the software T&E community to fully evaluate the software system performance. All in all, a successful PDR will go a long way towards minimizing program costs and schedule risks, and in improving the overall quality of the design.

d. The results of the requirements traceability, requirements stability, design stability, and CRU metrics should be presented at the PDR. The requirements should show an acceptable degree of completeness, traceability (SDD, software test plan (STP) to SRS/US/DS), and stability (SRS, US, DS, IRS,

SSS, SS/FD, and UFD). CRU allocations to lower level software should not exceed overall requirements.

e. The continuous evaluation process provides the PM with information to make the decision to move to the next phase(s). This warrants that the documents, metrics, reviews, evaluations, etc., are in the condition to be used to execute the next phases or that shortfalls and risks have been noted.

Section VI
Detailed Design Phase

6-16. Introduction

The detailed design phase can be described simply as the developer's efforts to allocate the baselined software top-level design to the detailed software design. Under normal circumstances, the detailed design is presented in one or a series of critical design reviews (CDRs) conducted by the software developer upon completion of a proposed detailed software design and prior to the coding of that design.

6-17. Detailed design activities

a. Objective one requires the demonstration that the detailed software design is adequate to permit software code development. In order to verify this objective, the following issues must be examined.

(1) Traceability should be evaluated for consistency between the approved preliminary software design and the proposed detailed software design. Both the US and DS <u>or</u> the SDD Part II and the IDD are utilized to document detailed software designs.

(2) The detailed design should be evaluated to determine the adequacy of the design to perform the functions/components identified in the preliminary design including both internal and external interface requirements. The detailed design should define a hierarchical structure of identifiable programs, subprograms, modules and units with the highest level of control logic resident at the top of the hierarchy and the computations or arithmetic functions resident at the lower levels. Evaluation of the detailed software design should address consistency, feasibility, supportability, possible constraints and rationale for the proposed approach.

b. Objective two calls for the presentation of the proposed software test requirements. The proposed software test requirements are defined in the STD Part I or software development test plan. The STD or software development test plan presented at the CDR contains the test cases necessary to perform formal qualification or cycle/system testing as defined in the software test plan or management plan (MP). The STD Part I should be developed in accordance with

DOD-STD-2167A, where applicable, and should explicitly state software test descriptions and test cases that will be used to test the software including stress testing, interface testing, regression testing, and built-in test validation. For information systems, the CDR presents information necessary to determine if planning for the cycle/system software development test (SDT) has been completed, including step-by-step procedures to address all test conditions IAW DOD-STD-7935A or DOD-STD-2167A, if applicable.

c. Allocation during this phase is the effort to implement the top-level design down to the explicit details necessary to generate the end-item software product. What results are well-defined details about interfaces, data flows, logic flows, databases, and all other design information short of actual operational code. In addition, program design language (PDL) as pseudo-code is generated as the link between the detailed design and end-item source code. Typically, if the Ada computer language is used, the PDL will be "compilable" and can actually be executed in simulators to gain early, valuable information about performance. This is the opportunity to invite the users to a user demonstration to see the design evolving. Once the detailed design is deemed to be mature, a CDR is held to evaluate and approve the detailed design prior to proceeding to the source code development phase. It is important to note that full maturity is not necessary to get approval at CDR, since the developer will need to have the flexibility to refine and optimize the design. However, the detailed design must be mature enough to allow for an intelligent decision to proceed forward -- this is very important both in minimizing program cost and schedule risks, and in improving the overall quality of the design.

d. Implementation of applicable metrics.

e. The configuration management function supports the test and evaluation efforts by storing and controlling the items of software design as they are evaluated and approved. Any changes to the design identified by the evaluation efforts are also identified and processed by the configuration management function prior to implementation. In this activity, the contractor develops the detailed structure or design of each software configuration item or subsystem/program, in terms of CSCs/modules/units and computer software units (CSUs). The software engineering activities are supported by (a set of) CDRs. The essential engineering efforts and decisions generated during this activity are normally documented in the SDD and IDD or the US and DS. The contractor's detailed software formal qualification test program, in terms of test responsibilities and test cases, is documented in one or more STDs or test cases in the PT.

The contractor places the complete versions of the SDD and the IDD or the US and DS under internal change control, as part of the developmental configuration. Even though not an element of the configuration identification or the developmental configuration, the contracting activity approved initial version of the STD or PT is also placed under internal contractor change control, after evaluation for adequacy, consistency, and traceability by the test and evaluation function.

6-18. Metrics during detailed design
The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	Breadth of Testing
✓ Schedule	✓ Reqts Stability	Depth of Testing
✓ CRU	✓ Design Stability	Fault Profiles
✓ SEE	✓ Complexity	Reliability

a. The SEE metric applies as one of the factors in evaluating the capabilities of various software contractors.
b. Additional information on metrics as applied in this phase can be found in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

6-19. CDR conduct and decision criteria
Decision criteria for this phase are shown in Table 6-5.

Table 6-5. Detailed Design Phase

Primary Responsibility	Products	Decision Criteria
Developer and PM	PDL, US(s)/SDD, STD/SDT, PT	PDL for detailed design User demonstrations CDR(s) conducted
PM & Software Developer & Gov't SQA or IV&V	Requirements Trace(s) Metrics Report(s)	Updated Acceptable degrees of: requirements traceability and stability; CRU allocations; design stability; complexity

a. For most software systems, the CDRs are reviews which take a substantial amount of time in order to adequately address all necessary issues. For some

systems, it would be appropriate to allocate two to three weeks for the CDRs. A successful approach used in the past has been to present the CDRs in iterative sections allowing time between each section for CDR participants to preview upcoming CDR information. Regardless of the approach used allocating a substantial amount of time can greatly influence the success of the CDRs. Particular attention must be given to allowing all responsible organizations to present their assessment of adequacy. If there is no IV&V agent assigned to the program, then the developmental and operational evaluators will provide their assessments of the progress of the design. After completion of the CDRs, the developer should publish and distribute copies of the CDR minutes.

b. The CDRs need to be realistic reviews. The overall objective is to provide the PM with enough information to make an informed decision to proceed. Active participation in the form of presentations by the user, software engineering, software quality assurance (and others) are essential in achieving the CDRs objectives. These presentations should include the results from the continuous evaluations conducted to date. Again, if there is no IV&V agent, the developmental and operational evaluators will provide their assessments of progress. The PM must be presented with all of the facts and perspectives in order to:

(1) Assess that the proposed detailed software design is adequate to permit software code development (SDD Part II and IDD).

(2) Assess the adequacy of proposed test requirements (STD Part I).

(3) Assess current metrics and other results from the continuous evaluations.

c. Successful completion of CDRs will provide several benefits to the software T&E community. Among these benefits is the knowledge that the detailed design successfully addresses all system requirements and is adequate to proceed with the development of software code, and that no concerns from the software T&E community have been overlooked. All in all, a successful CDR will go a long way towards minimizing program costs and schedule risks, and in improving the overall quality of the design.

d. The results of the requirements traceability, requirements stability, and CRU metrics should be presented at the CDR. The requirements should show an acceptable degree of completeness, traceability, and stability. CRU allocations to lower levels of software should be compliant with the allocations in the specifications. If complexity values for CSUs exceed thresholds, redesign should occur unless an adequate rationale is given.

Chapter 7
Software T&E During Software Development Phase

7-1. Introduction

a. This chapter discusses the software activities involved during the following stages of software development: coding and CSU/unit/module testing, CSC/program integration and testing, CSCI/cycle/subsystem testing, and system integration and testing. It describes the types of documents developed, tests and evaluations to be conducted, and decision criteria for each level of testing.

b. The test and evaluation activities described in this chapter may be repeated for iterations of the design. Frequently some portions of the detailed design are ready for code and test prior to others. This provides the flexibility to move on for software which meets the criteria for this phase. The objective is to provide flexibility to use a variety of development methods (spiral, incremental, sequential).

c. During all levels of software development testing, the software developer has control over the software T&E process. Software quality assurance and validation and verification efforts are significant during each level of software development testing.

7-2. Coding and CSU/unit/module test

a. Test activities.

(1) During coding and unit (CSU)/module testing, the software development folder (SDF) or program folder (PF) is the key to accountability. Software is developed in accordance with the detailed design and software coding standards; unit test procedures are developed by the coder. Static analysis, data flow analysis and code walk-throughs are performed to assess software modularity, quality, and maintainability early in the development. Use of coding standards is paramount to controlling coding and leads to a better product.

(2) Coding and unit (CSU)/module testing is the lowest level of testing executed on software. The purpose of unit testing is two-fold. First, to validate the requirements expressed in the unit specifications or software requirements specifications. Second, to ensure that all unit/module source statements have been executed, each conditional branch has been taken, and that all boundary values (e.g., minimum-maximum values) and exit objectives are accepted. Testing during this phase is conducted by the developer.

(3) Considerations for coding and CSU/module testing include the test environment and test data. The test environment for module testing usually consists of local test bed hardware. Test data at this

test level will be generated by the developer; if a set of benchmark test files (BMTF) exists, it should be used in addition. It is important that results of testing are recorded in the SDFs or PFs along with the inputs that generated those results. Only units which have been successfully tested are permitted to be integrated into components or programs for the next level of testing.

b. Evaluation activities. To gain insight into the software developer's progress, SDFs or PFs are reviewed. All information concerning the status of a specific unit (CSU) or module is kept in the SDF or PF; this typically includes:

(1) Informal software test descriptions, developer test results, informal coding and CSU/module notes.

(2) Identification of other unit/modules or CSU/CSC(s) that interface with this unit (CSU)/module.

(3) Data flow diagrams.

(4) Test results.

(5) Software trouble reports (STRs) or problem reports (PRs).

(6) Application and analysis of applicable metrics.

(7) The requirements traceability matrix.

c. The developer is responsible for the SDFs and their contents. Evaluations of the SDFs are usually conducted by an independent organization or management structure separate from the software developer (i.e., developer's quality assurance group and/or the Government's SQA, verification and validation (V&V) or IV&V organizations). Completed and published system documentation and training packages are not normally available at unit/module level testing. However, if documentation is available, it should also be reviewed.

d. The configuration management function supports the test and evaluation efforts by storing and controlling the items of software design and code as they are tested, evaluated and approved. Any changes to the design or code identified by the test and evaluation efforts are also identified and processed by the configuration management function prior to implementation. In this activity, the code is developed that implements the previously defined requirements and design. Testing is performed on the actual coded items. The result of this activity is a set of coded items, that have been individually tested and found suitable for integration into the completed software product. The configuration management function supports the test and evaluation efforts by storing and controlling each item as it is coded and evaluated. The contractor/developer controls changes to the detailed design that result from the code and unit test activities. As each software unit

successfully passes unit test, it is entered into the developmental configuration.

e. Metrics. The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	✓ Breadth of Testing
✓ Schedule	✓ Reqts Stability	✓ Depth of Testing
✓ CRU	✓ Design Stability	✓ Fault Profiles
✓ SEE	✓ Complexity	Reliability

(1) Measured values for computer resource utilization become available at this time.

(2) With the initiation of code testing, data to support the breadth and depth of testing metrics can be collected and analyzed.

(3) Additional information on the application and analysis of metrics can be found in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

f. Decision criteria. Associated products, documents and decision criteria are shown in Tables 7-1 and 7-2.

Table 7-1. Coding and Unit (CSU)/Module Test

Primary Responsibility	Products	Decision Criteria
S/W Developer and Gov't. SQA or IV&V	Requirements Trace(s)	Updated
	Metrics Report(s)	Acceptable degrees of: requirements traceability and stability; CRU allocations to utilization; design stability; breadth and depth of testing; fault profiles

Table 7-2. Coding and Unit (CSU)/Module Test Documents

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	CRISD	Preliminary	Maintenance Manual	Draft
	SDFs	In Process	Program Folders	None
	STDs	Draft	Procedures for SDT (section 5)	Draft

7-3. CSC/program integration and test
During this level of testing, the developer integrates the modules into programs or the computer software units into CSCs. Unit level or module level testing must have been successfully completed prior to CSC/program level testing. All CSCs/programs should accept valid inputs and produce correct outputs.

a. Test activities. Program-level software development plan or CSC integration procedures will be used by the developer to execute program-level tests. At this point, with much of the software integrated, limits and bounds are tested, and multiple paths are executed to ensure that the integration is proceeding in a robust manner. Additionally, testing such as run-time efficiency and stress testing should also be addressed. All discrepancies, malfunctions and errors (prioritized and categorized IAW DOD-STD-2167A, Appendix C) should be documented in problem reports or trouble reports. Results of the testing are recorded in SDFs or PFs.

b. Evaluation activities. Software quality assurance, IV&V, and V&V personnel are generally performing the evaluation on-site and reporting to the remainder of the software T&E community. Required evaluations at this time include:

(1) Tracing requirements from test results back to the test plans/procedures and the requirements documents.

(2) Auditing SDFs/PFs.

(3) Implementation and analysis of applicable metrics.

c. The configuration management function supports the test and evaluation efforts by controlling the coded items as they are integrated. Any changes to the design or code identified by the test and evaluation efforts are also identified and processed by the configuration management function prior to implementation. In this activity, the coded items are integrated into a set of CSCs or programs. The result of this activity is a coded item that is ready for formal qualification testing or subsystem/cycle testing. The detailed test procedures to be used for formal qualification or cycle/system testing are documented in the STD or PT test cases. This activity is supported by one or more TRRs that determine the readiness of the software for formal qualification test (CSCI or cycle and system). The developer controls changes to the detailed design that result from the CSC/program integration and test activities. All changes to the units/modules that result from CSC/program integration and test are internally controlled and entered into the development configuration.

d. Metrics. The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	✓ Breadth of Testing
✓ Schedule	✓ Reqts Stability	✓ Depth of Testing
✓ CRU	✓ Design Stability	✓ Fault Profiles
✓ SEE	✓ Complexity	Reliability

(1) Breadth and depth of testing become more refined in this phase.

(2) Additional information on the application and analysis of metrics can be found in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

e. Decision criteria. Associated products, documents and decision criteria are shown in Tables 7-3 and 7-4.

Table 7-3. CSC/Program Integration and Test

Primary Responsibility	Products	Decision Criteria
S/W Developer and Gov't. SQA or IV&V	Requirements Trace(s)	Updated
	Metrics Report(s)	Acceptable degrees of: requirements traceability and stability; CRU allocations to utilization; design stability; breadth and depth of testing; fault profiles
PM & Developer with SQA and IV&V	TRR(s)	Ready to perform CSCI & system/cycle tests

7-4. CSCI/cycle/subsystem test

a. Introduction. This section discusses the activities involved during CSCI/cycle/subsystem level tests. During this level of testing, the developer integrates programs into subsystems or the CSCs into CSCIs. Program or CSC level testing must have been successfully completed prior to CSCI/subsystem level testing. It is sometimes combined with system level testing since interfaces need to be exercised. If combined, all the test requirements and products shown in both test descriptions apply. Prior to running each subsystem/CSCI/cycle test, a formal test readiness review IAW MIL-STD-1521B covering that test must have been held by the PM and developer.

b. Test activities.

(1) Formal developer's tests consist of

Table 7-4. CSC/Program Integration Documents

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	CRISD	Preliminary	Maintenance Manual	Draft
	SDFs	In Process	Program Folders	None
	STDs	Draft	Step-by-step procedures in PT	Draft
			User Manual (UM)	Draft
			End User Manual (EM)	Draft

CSCI/subsystem or cycle/system levels of testing. This testing involves the combining or linking of modules/programs or CSCI/subsystems into major processes (e.g., basic cycle, as-required cycle, fire control, missile guidance). Considerations for this testing level include: software, software development, test plan, the test environment, test data, documentation, training materials and evaluation of the test. The test plan will be prepared by the tester. The test plans need to consider the operational mode summary/mission profile from the UFD in planning peak loads and volumes, numbers of transactions, and multithread test conditions.

(2) The CSCI/subsystem test plan (STP) and associated software test descriptions (STDs) are reviewed and approved by the Government; use of a quality assurance group is required. Cycle/system or CSCI/subsystem level testing will be executed using local test bed hardware, preferably on the target hardware. Test drivers for the CSCI or subsystem test which emulate system loading consistent with the OMS/MP are essential for early identification of faults which impact the accomplishment of user requirements. BMTF may also be used for this level of testing. Draft software documentation materials being prepared by the software developer must continue to be developed and refined so that the final developer test iterations of testing will use final draft versions of the documentation items.

(3) As part of the test reporting process, all problems and deviations encountered during the tests will be prioritized, recorded, and placed into the SDFs or program folders and reviewed by the appropriate functional or technical representative. The T&E community will assist in prioritizing the PRs or STRs.

c. Evaluation activities.

(1) Cycle tests conclude with the tester's preparation of a draft test analysis report.

(2) The final report includes system level testing. Only when finalized does it get furnished to the PM and others. The developer concludes CSCI/subsystem test activities by updating the source code and design documentation, recording the STRs or PRs, and preparing the test report. It is furnished to the user representative and PM/PO for comments. After consideration of comments, it will be forwarded for review by the approving authority and the developmental tester, developmental evaluator, operational evaluator, and operational tester.

(3) CSCI/subsystem tests are generally the officially witnessed software acceptance tests (formal qualification tests (FQTs)), with official Government representatives present for the test execution.

(4) The implementation and analysis of the applicable metrics are part of CE.

d. The configuration management function supports the test and evaluation efforts by ensuring that the correct versions of the coded items are provided for the formal qualification testing, and that only approved changes are incorporated into the tested items. In this activity, formal qualification testing of each CSCI is conducted according to the STP and STDs, and documented in (a set of) STRs or RTs. Following successful completion of this testing or system integration testing, an FCA and PCA are performed for each software CI. The purpose of the FCA is to determine that the software performs in accordance with the requirements documented in the current configuration identification. The purpose of the PCA is to determine that the coded software is accurately and completely reflected in its associated documentation, such as the software product specification (SPS) which includes the software engineering environment (SEE), the IDD, or the completed US, DS, SSS, and the source and object code listings. The contractor identifies the exact version of each software item to be delivered in a VDD or implementation procedures (IP). Following completion of the preliminary FCA and PCA, the Army Program/Project Office authenticates the SPS or the design and build documents and enters them into the product baseline for the system. The contractor ensures that all changes that result from testing are internally controlled and entered into the developmental configuration. Once the software is entered into the product baseline, all changes to the software require prior approval. At this point, the developmental configuration ceases to exist. It is recommended that a preliminary or iterative PCA and FCA

be done and updated during the system test phase. Final results should be an input to the maintenance evaluation.

e. Metrics. The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	✓ Breadth of Testing
✓ Schedule	✓ Reqts Stability	✓ Depth of Testing
✓ CRU	✓ Design Stability	✓ Fault Profiles
✓ SEE	✓ Complexity	✓ Reliability

f. Decision criteria. Associated products, documents and decision criteria are shown in Tables 7-5 and 7-6.

Table 7-5. CSCI/Cycle/Subsystem Test

Primary Responsibility	Products	Decision Criteria
S/W Developer and Gov't.	Requirements Trace(s)	Updated
SQA or IV&V	Metrics Report(s)	Acceptable degree of: requirements traceability and stability; CRU allocations to utilization; design stability; breadth and depth of testing; fault profiles; reliability

7-5. System integration test

a. Introduction. This section discusses the activities involved during system integration tests. During this level of testing, the developer integrates CSCIs with CSCIs and hardware/software configuration items to complete the system. Cycle or CSCI testing must have been successfully completed prior to system testing. As indicated, it may be combined with CSCI and cycle testing.

b. Test activities.

(1) Formal developer's tests consist of system integration testing. This testing involves the combining or linking of CSCI or subsystems into major processes. Considerations and responsibilities for this testing level include: software, software development, test plan, the test environment, test data, documentation and training materials and evaluation of the test. The test plan will be prepared by the tester (e.g., developer) and will use the loads,

Table 7-6. CSCI/Cycle/Subsystem Documents

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	CRISD	Preliminary	Maintenance Manual	Final
	SDFs	In Process	Program Folders	None
	STDs	Final	User Manual (UM)	Draft
	STRs	In Process	PRs	None
	Software Product Spec. (SPS)	Draft	Computer Operation Manual	Draft
			End User Manual (EM)	Draft
	Ver. Descrip. Document	Draft	Implementation Procedures	Draft
	S/W Test Report	Final	Test Reports	Draft - Cycle Portion

volumes, stresses, and conditions documented in the users' functional descriptions as the basis for test design.

(2) The system integration test plan and associated STDs are reviewed and approved by the Government. The cycle/system test plan is reviewed and approved by the Government (if contracted out). For all software, system integration testing will be executed using local test bed hardware, preferably on the target hardware. BMTF may be used for this level of testing. Draft software documentation materials being prepared by the software developer must continue to be developed and refined so that the final developer test iterations will use final draft versions of the documentation items.

(3) As part of the test reporting process, all problems and deviations encountered during the tests will be prioritized, recorded, and placed into the SDFs or program folders and reviewed by the appropriate functional or technical representative. The T&E community will assist in prioritizing the PRs or STRs through the software corrective action review team (SCART).

c. Evaluation activities.

(1) System integration testing concludes with the tester's preparation of a test report. It is

furnished to the user representative and PM and commented upon. After consideration of comments, the software test report will be forwarded for review by the developmental tester, developmental evaluator, operational evaluator, and operational tester. The software test report forms the basis for the PM's developmental test readiness statement (DTRS) for software related issues.

(2) The developer concludes system integration test activities by updating the source code and design documentation, resolving the STRs or PRs and preparing the test report. System tests may be officially witnessed software acceptance tests with official Government representatives present for the test execution. Metric implementation during the system testing phase is dependent on the number and severity of errors detected and their effect upon the software requirements and design. Corrective action may require requirements changes, redesign, and regression testing at all levels (i.e., revalidation).

(3) Functional and physical configuration audit(s) IAW DOD-STD-1521B as a minimum, and a maintainability evaluation will be performed to ensure that the software documentation and performance meets requirements. The maintainability evaluation will be performed by PDSS personnel to demonstrate that the software can be maintained IAW the approved maintenance concept and provide input to the required software supportability and suitability statement for materiel release. The approved maintenance concept indicates whether the software will be maintained by a designated Government CDA or LCSEC or whether it is contractor logistics support (CLS). Issues addressed in the evaluation may include the items below ensuring that:

(a) Sufficient resources exist for support, including additional computers, validated tools, code generation tools such as compilers, linkers, and debuggers; requirements and design tools such as computer aided software engineering (CASE) tools; such as documentation and training.

(b) Software documentation is understandable, complete, and in a format that is compatible with the software tools being used.

(c) Complexity metrics are reviewed for code simplicity.

(d) Programmer's manuals are adequate and programmers are trained in all required languages.

(e) Computer resource utilization (CRU) metrics are reviewed to ensure that sufficient memory and timing reserves exist to allow for software maintenance.

(f) Transition plans for software support are reviewed.

(g) The results from FCA and PCA are

incorporated into the production baseline.

(h) A configuration control board has been established.

(i) Configuration management policies and procedures are in place.

(j) Configuration control mechanisms for release and distribution are in place.

(k) The status of all metrics collected are reviewed to determine requirements met, depth and breadth of testing, and faults remaining.

d. Metrics. The metrics with a check mark apply at this time:

✓ Cost	✓ Reqts Traceability	✓ Breadth of Testing
✓ Schedule	✓ Reqts Stability	✓ Depth of Testing
✓ CRU	✓ Design Stability	✓ Fault Profiles
✓ SEE	✓ Complexity	✓ Reliability

e. Decision criteria. Associated products, documents and decision criteria are shown in Tables 7-7 and 7-8.

Table 7-7. System Test

Primary Responsibility	Products	Decision Criteria
S/W Developer and Gov't. SQA or IV&V	Requirements Trace(s)	Updated
	Metrics Report(s)	Acceptable degrees of: requirements traceability and stability; CRU allocations to utilization; design stability; breadth and depth of testing; fault profiles; reliability

Table 7-8. System Test Documents

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	CRISD	Final	Maintenance Manual	Final
	SDFs	In Process	Program Folders	None
	STDs	Final	User Manual (UM)	Draft
			End User Manual (EM)	Draft
	STRs	In Process	PRs	None
	SPS	Final	Computer Operation Manual	Final
	Ver Descrip. Document	Final	Implementation Procedures	Final
	S/W Test Report	Final	Test Report	Final

Chapter 8
System Developmental Test and Evaluation (DT/DT&E)

8-1. Introduction

a. This chapter describes the software test and evaluation considerations for systems containing software. During this phase, the Government controls the T&E process. The developmental test phase consists of a series of system-level tests, as defined in AR 73-1 and Part Four of DA Pamphlet 73-1, not necessarily conducted consecutively. The software baseline is frozen for this phase of testing in order to maintain data consistency. The baseline is not modified during this phase of testing, unless severe problems are encountered. If the baseline is modified, regression testing is required to ensure detected problems were corrected and additional problems were not introduced into the software. Prior to entering developmental test, a developmental test readiness review (DTRR) is conducted which determines the maturity of the software and system.

b. The DTRR convenes as a working group whose members include the principal TIWG members plus others deemed appropriate. As a minimum a DTRR will be conducted before developmental test. The DTRR reviews all pre-start activities and requirements which may impact the execution of the test as scheduled and as planned by the TIWG. The objective of the review is to determine what actions are required to assure that resources, training, planning, and test equipment will be in place to support the successful performance of the test and to ensure that the T&E planning, documentation, resources, design maturity/ configuration, and data systems have been adequately addressed. Principal DTRR attendees include representatives of the PM/MATDEV (Chair) and the materiel developer's safety office (if applicable), ILS office, and product or quality assurance & testing office; developmental tester; developmental evaluator/assessor; operational tester; operational evaluator; logistician; CBTDEV, trainer, and manpower and personnel integration (MANPRINT) discipline members. The DTRR conduct and other details are described further in Part Four of DA Pamphlet 73-1. Figure 8-1 shows a checklist of software related questions discussed at the DTRR.

8-2. Entry objectives

a. In order to enter developmental test, the following must be completed: evidence of successful completion of developer's tests, formal and informal, consisting of test report, developer test documentation (e.g., updated test plan and procedures, STR/PR/test incident reports (TIR) or engineering change proposal-

1. **General.**
   a. Have configuration items related to software been identified? Are changes under configuration control?
   b. Has government reviewed/approved all software test plans/procedures/test results?
   c. Are all functional requirements clearly identified?
   d. Is there confidence that software functions will execute properly (walk-throughs, B5/C5 MIL-STD-490, DOD-STD-2167A or DOD-STD-7935A requirements and design specifications, resource allocation)?
   e. Is there a clear understanding of what software functions will be tested by the developmental and operational testers?
   f. Is the Computer Resource Management Plan current, if applicable? (see AMC-R 70-16)
   g. Have plans been formulated to deliver all software documentation prior to DT/OT?

2. **Safety.** Does the system or software have any safety limitations (operational limitations for test personnel) either inside or outside the required performance envelope? If so, what corrective action has been taken or is any planned?

3. **Reliability, Availability, Maintainability.** Have the failure definition/scoring criteria for software been established?

4. **Configuration Management (AR 70-37).**
   a. Has a preliminary product baseline technical documentation package been established?
   b. How is the software configuration being controlled?
      (1) Has a configuration management plan been approved which includes provisions for government approval of engineering change proposals-software and waivers/deviations?
      (2) Has a Configuration Control Board been established?

5. **Testing.** Compare the requirements document against test results to date. There must be a reasonable assurance (confidence) that the system to be tested can satisfactorily pass technical tests or equivalent independent government tests.
   a. Do test results show that system and software requirements will be met? (Show quantity tested, what tests were conducted, and results).
   b. Have the tests addressed all system and software requirements?
   c. What problems have occurred and how have they been resolved?
   d. Have critical/major test incident reports from developmental and operational testing been closed out? (List and summarize corrective action.)

6. **Integrated Logistics Support.**
   a. Supportability.
      (1) Has the PDSS agent been identified?
      (2) Has the software maintainability evaluation been conducted?
   b. Training. What version of software was used for training?

7. **Test Resources.** Are any unique facilities, equipment or software instrumentation required and will they be available at the test site(s)?

Figure 8-1. DTRR Software T&E Checklist

software (ECP-S) generated), QA certified software baseline, baseline name and version identifiers. A DTRS is prepared by the PM and submitted to the developmental tester. Preferably, there should be no open priority 1 or 2 problem reports or TIRs from previous testing. Serious consideration and severe test limitations may result if DT occurs with open problem reports. It may cause DT to be repeated due to invalid data.

b. Documents include an updated IEP or IAP if independently evaluated or assessed, either test design plan (TDP) and detailed test plan (DTP), or test plan (PT). The system documentation for the change package will be in final draft form. An approved TEMP is required to enter developmental testing.

8-3. Activities

a. System test. System testing is generally defined as testing which examines the compliance of the system (hardware and software) to its requirements. This differs significantly from lower levels of testing in which the product is evaluated against its design. Using the requirements as the standard measure, system testing leads to an evaluation of design rather than evaluation of the implementation of the design. The approach to system level testing primarily utilizes black-box techniques (i.e., examination of the relationship of inputs to outputs as specified in the requirements).

b. Formal developmental test. DT is a Government system-level test which focuses on requirements. It verifies system performance and the ability of the user to perform mission-essential activities. DT is executed on target hardware using conditional data files. Critical to the success of future tests is the ability to drive or load the system software IAW the OMS/MP defined by the user.

(1) The tester will coordinate all activities with the PM and provide guidance for the resources required to support testing. The test may be executed using an ad-hoc group of system users and/or operators. At the beginning of DT activities, computer operation and users manuals, conversion documentation and training package materials will be in final draft form and will be used in the execution of the DT processes.

(2) The tester writes a DTP or PT, in response to the IEP/IAP and TDP. Well-defined requirements are necessary to develop the DTP or PT for all evaluation issues. These requirements will allow testers to tailor the generic test areas to the specific software application. The following approach addresses the software requirements in the context of DT:

(a) Trace critical system requirements to the software requirements.

(b) Identify the input conditions possible for each software requirement. This leads to the development of a test coverage matrix. The test coverage matrix has cells which represent input conditions and the tests addressing them.

(c) Design and execute tests to address the most important test conditions. It will generally not be possible to provide coverage for all input conditions, so testing should focus on the more critical or more likely test conditions with respect to the expected deployment environment. This serves not only to ensure that technical requirements are met, but also ensures readiness for operational testing following developmental test.

(3) Areas addressed in the DTP or PT should include: performance, interoperability, usability, security, and safety.

(4) The following testing areas are addressed when testing software performance:

(a) Accuracy -- this has the following aspects:

- Determine if correct decisions are made (i.e., yes/no, true/false), or the best choice of several alternatives is chosen.
- Proximity to expected values. This is applicable when a numerical computation is performed and there is a tolerance associated with resultant output. A computation is considered accurate when it is within a specified tolerance.

(b) Speed -- determine if functions are performed within specified time tolerances.

(c) Repeatability -- determine if consistent conditions/events produce consistent results or if the software appears to compute in a random way.

(d) Robustness -- by this we mean "crash-resistance." This applies to any area of testing whether computational, interoperative or operational.

(e) Stress -- verify that volumes, loads, varying conditions, or peak processing do not degrade the system except IAW requirements.

(5) Testers address the two interoperability areas, intersystem and intrasystem, in the same way. The following are checked:

(a) Acceptance of legal transmissions.

(b) Rejection of illegal transmissions. The system should not degrade or crash when illegal attempts are made.

(6) Usability performance testing addresses the user-machine interface. Test areas addressed are:

(a) Acceptance of legal input.

(b) Rejection of illegal input. Again, the system should reject illegal values, not degrade or crash.

(c) User understandability. Determine if displays/entries are understandable for the user.

(d) Determine if correct input yields expected output.

(7) Safety testing is required for software. This testing is performed if the software could cause the system to engage in an unsafe action toward personnel, equipment or materiel.

(8) The independent developmental evaluator shall monitor the test, but not participate as a test director. The independent developmental assessor may actually be the test director.

(9) The developer is not to participate as a test director or test member. When difficulties occur, the developmental tester may request the developer's participation. The policy is to control changes to the software during the testing. If the numbers of problems reported at the priority 1, 2, or 3 level become excessive, thereby impairing the test objectives, the developmental tester will suspend or terminate the testing in coordination with the developmental evaluator/assessor.

(10) Problems discovered during DT are recorded as system/software anomalies. Problems reported use either the TIR, PR or similar format. These forms have a developer's analysis section which is used for corrective action reporting. All software problems occurring during test (including problems with test procedures) will be recorded, categorized and prioritized IAW DOD-STD-2167A, Appendix C.

(11) Data contributing toward reliability, depth and breadth of testing, and fault profiles is collected. This looks at software faults discovered and closed, test adequacy, and failure patterns.

c. Evaluation.

(1) Results of testing are prioritized and categorized by a Government data review board. Board principal members shall be the PM, user representative, developmental evaluator/assessor, and developmental tester. Test results are evaluated by the developmental evaluator/assessor IAW the IEP/IAP.

(2) Developmental evaluation is a comprehensive verification and validation process conducted to ensure that all capabilities and requirements of the system are exercised and analyzed IAW the issues and criteria stated in the IEP/IAP and TEMP. Elements of the developmental evaluation may include but are not limited to the following:

(a) Software performance -- determine how well the software supports system performance. Examples of performance issues are:

- System response time is evaluated for conformance to specified time tolerances.

- System accuracy is evaluated by correctness of system level decisions and the proximity of computations to expected results.
- Recovery/restart procedures are evaluated to ensure that users can overcome potential processing malfunctions.
- Conversion processes are evaluated to ensure that data handling procedures are described and executed in a correct manner (e.g., left of baseline). A similar evaluation must also be performed for processing which generates the converted or initial database into the new system format (e.g., right of baseline). File contents resulting from the conversion process must be verified and validated according to the methodology and criteria specified in the DT test plan.

(b) Interoperability -- the degree to which data is correctly exchanged and interpreted between systems. It is very important to test interoperability using actual target systems. The Army Interoperability Network (AIN) at Ft. Monmouth, NJ, is available for performing interoperability testing between actual target systems. Basically, there are two types of interoperability: intrasystem and intersystem. Examples of interoperability issues are:

- Evaluate the acceptance of legal transmissions and rejection of illegal transmissions.
- Evaluate whether prioritization of transmissions is done correctly.
- Evaluate how the system performs under load.
- Evaluate how well the system user is able to manage the system to include interactive terminal interface, cycle/system set-up, and input/output control.
- Evaluate the interface considerations with respect to ease of data handling through cycle processing, inter-system data transfer, transmission of data over communications links, and time sharing links are functioning properly.

(c) Usability -- The effort required to learn the human interface with the software, to prepare input and to interpret output of the software. Usability evaluation addresses the man-machine interface. Examples of usability issues are:

- Evaluate system response to user interaction. Systems should accept legal entries and reject illegal entries without any system degradation.

- Evaluate output products such as terminal displays, hard copy reports, magnetic tape and direct access files are correct and disposition for these products are clear and adequate.

(d) Maintainability -- The effort required to modify an error in the software. Maintainability is evaluated by assessing the quality of software documentation and quality of code. The results of maintainability evaluation conducted by the PDSS personnel should be used here. Examples of maintainability issues and how they are evaluated are:

- Documentation quality is determined by its completeness, correctness, and traceability (i.e., determine if the requirements are implemented in the design and if the design is implemented in the code).
- Code quality is measured by programming style (e.g., complexity, modularity and commenting), reserve memory capacity and software metrics. The ability of the developer to identify and correct software problems indicates how maintainable the software is.
- Reserve memory and processor capacities are evaluated to ensure they are adequate to allow for anticipated expandability.
- Training is evaluated to ensure the adequacy of appropriate training manuals, classroom and/or on-the-job instruction, and problem reporting procedures, if applicable.

(3) The developmental test report is written by the independent developmental tester and submitted to the independent developmental evaluator and PM.

8-4. Metrics during developmental test and evaluation
The metrics with a check mark apply at this time:

✓ **Cost**	✓ **Reqts Traceability**	✓ **Breadth of Testing**
✓ **Schedule**	✓ **Reqts Stability**	✓ **Depth of Testing**
✓ **CRU**	✓ **Design Stability**	✓ **Fault Profiles**
✓ **SEE**	✓ **Complexity**	✓ **Reliability**

a. Data from any of the metrics may be used to assist in determining readiness for developmental test.

b. Of particular interest are breadth and depth of testing, reliability and fault profiles as they pertain to the activities performed during the developmental test. The traceability and stability metrics and CRU contribute towards the maintainability evaluation.

8-5. Decision criteria

a. All systems use an independent evaluation report/independent assessment report (IER/IAR) and a test report. The IER/IAR is the evaluation of how well the system met the critical issues stated in the IEP. This evaluation should include software metrics and any other outstanding software problems. The items needed to exit DT and enter operational testing are a developmental test report and successful completion of the operational test readiness review (OTRR). To reduce risk, IERs/IARs should be complete prior to an IOT and preferably prior to any OT. A favorable test result is a necessary condition to make the decision to enter OT.

b. If DT is to be followed by OT, there may be no open priority 1 or 2 software problem reports, IAW DOD-STD-2167A, Appendix C. Software problems fixed during DT require evidence of comprehensive regression testing prior to admittance to operational testing. This includes updates to documentation and impacts of any work-arounds required. The user may require that additional software problems be fixed prior to OT.

Chapter 9
Operational Testing (OT)

Section I
Introduction to Software T&E During Operational Testing

9-1. Purpose

a. This chapter defines methodology and procedures for operational evaluation and test implementation of systems which contain software. Operational testing focuses on how the software supports the system mission, and the capability of the user to employ the system. Evaluation of software at this time aims for successful operational testing in the operational configurations, loads, and environments; to assist in determining adequacy of test coverage so evaluators are confident in evaluations of operational effectiveness; and to use evaluations of the Government's ability to provide adequate post-deployment software support.

b. Operational testing is distinct from other tests in these ways:

(1) It is conducted on systems with typical users (e.g., troops, user organizations) in an operational environment that is as realistic as practical.

(2) OT uses personnel with the same skills and training as those who will operate, maintain and support the system when deployed.

c. Realistic operational environment includes operations conducted IAW the system's wartime, mobilization, or similar operational mission profiles which specify the number, type and frequency of combat operations or specific transactions/processing during a period of time. The test design used in OT should use the SOPs, tactics and doctrine (if applicable), logistics and maintenance support concepts planned for use when the system is deployed/fielded. The security level and threat levels, as defined in the ORD or MNS, represent the capabilities postulated in the field.

d. OT can provide data not obtainable through other sources and may be used to validate previous analyses (e.g., OAs based on informal OTs or DT).

9-2. Objective

The objective of operational testing and evaluation is to determine the extent to which the software supports, and can continue to support, the operational requirements of the user. A large portion of the functions performed by software in automated systems (battlefield or information) cannot be directly observed by a user or system operator. The sheer amount and complexity of software in these systems precludes exhaustive testing during operational testing. The objective of this methodology is to

ensure, to the maximum extent feasible, that user-essential system functions are not compromised by faulty software products and that functions performed by software are done properly and consistently.

9-3. Operational testing

a. Operational testing varies with the time period during which the tests occur. Early in the overall software and system development, the user and the developer may elect to plan and execute tests and evaluations which focus on specific issues of concern. These operational tests are called FDTE, EUTE, or limited user tests (LUT). For example, new systems which automate formerly manual functions represent considerable challenge to the using community. Informal operational or limited user tests are planned specifically to meet this challenge. The objectives of these tests and evaluations are:

(1) Exploring the tactics and doctrine, as defined in the ORD, for using the system.

(2) Determining how best to implement the user interface.

(3) Determining how to divide the workloads between users at different sites or using different portions of the system.

(4) Assessing the standard operating procedures for using the system.

(5) Getting user feedback on understanding the system (e.g., data inputs, error messages, screen designs, how the work flows, the transactions, how other systems provide inputs, how to handle recovery, what are the minimum essential functions to perform the job).

(6) Exposing the user to the system as it develops to ensure user feedback and system designs which meet needs and expectations.

(7) In the accelerated development/fielding acquisition strategy a limited user test is conducted to prove out the operational testbed. This testbed is comprised of the target hardware and NDI software (such as commercial operating systems, database management systems, etc.) that form the basis of the operational system. No application software is tested at this time. As each application software block is developed it undergoes an initial operational test on the testbed.

b. Results of informal operational or limited user tests are assessed and evaluated to a specific set of issues and criteria for input to decisions (Milestones I and II) prior to the production/deployment milestone. Evaluations of these tests may be in the form of an OA or an AOA prepared by the independent operational evaluator. Results are used to feed back into the system design and implementation.

c. Informal operational or limited user tests cannot replace the initial operational test (IOT) used for the Milestone III decision. However, they are used to provide supplemental data, thereby reducing the scope of the formal operational tests. Formal operational tests and their associated evaluations, if required IAW AR 73-1 and AR 25-3, are crucial elements of the review process which results in production/deployment decisions at Milestone III. Formal operational tests have been called by terms such as operational test (OT), initial operational test (IOT), follow-on operational test (FOT), multi-service operational test (MOT), joint test (JT), system acceptance test or software acceptance test (SAT). Formal OT is required and conducted on all Army systems containing software, including executive software, new developments, NDI and/or those in the PDSS phase. OT, under specific conditions outlined in AR 73-1 and Part Five of DA Pamphlet 73-1, may be combined with developmental testing. The extent and focus of the formal OT is determined by the life cycle phase of the system, whether independent evaluation is required, the acquisition category of the system, and whether the system is on the DOD Oversight List.

9-4. Entry objectives

a. Operational test readiness statement (OTRS). The PM, user representative, and trainer provide statements that, in their area of responsibility, the system is ready to undergo OT. The topics discussed are in the OTRS part of the information presented during OTRRs.

b. Operational test readiness software assessment. The evaluator assesses the ability of the software to support the objectives of the operational test before committing resources for its execution. This OT readiness assessment involves the evaluation of whether the software to be used in the OT will run under the scenarios and types of conditions planned. Developmental testing, software requirements verification testing and other forms of software testing (Government-witnessed IV&V, for example) are used to support the assessment of the software readiness for OT. However, before such tests can be considered, the priority software requirements and conditions for test are compared to the subject test plans. This comparison will be rigorous enough to provide confidence that the software will not degrade or terminate system performance in the upcoming OT.

(1) Completed software developmental tests. The operational evaluator ensures that the Government developmental testing conducted is sufficient to support the OT readiness assessment. The final review of the developer's technical and Government

developmental test results, as presented by the PM, IV&V agent, and the users, and the acceptance of the software for use in OT is done at the OTRR.

(2) OT version description. The operational evaluator includes, as part of the OT readiness assessment, a clear statement of the version of the software to be used in operational test. Any deviations in that version from the design software or from the software intended for fielding and the impact of any omissions or deviations in the test or the evaluation will be described. Systems which have excessively patched software, incomplete software (e.g., lacking required functions), software which is not IAW its associated documentation, or software lacking tight change control will not be allowed to proceed to OT. The software configuration management (CM) that is used by the software developer should identify the anticipated schedule for software releases and publication of software documentation. In preparation for the OTRR, the organization responsible for CM is tasked to provide the operational evaluator with the OT software version description. The operational evaluator summarizes this description in the OTRR briefing.

c. Software problem reports. Priority 1 and 2 software problem reports must be resolved prior to OT. The system may be allowed to proceed to OT with open problem reports (priorities other than 1 or 2) provided concurrence is obtained from the user representative. Work-arounds may be necessary for these open problem reports in order to avoid delaying the start of OT. However, these must be clearly specified, trained for, and accepted by the user representative.

d. Operational test readiness review (OTRR).

(1) OTRRs are required for formal operational tests whether independently evaluated or not. Informal operational or limited user tests may also require OTRRs prior to test conduct as detailed in the TEMP. The results of the operational test readiness assessment are presented and metrics reported. A summary of the planned OT test scenarios and status of instrumentation, if any, are presented. The relevance of all unresolved critical and serious software trouble/problem reports is discussed in terms of their potential impact on the planned scenarios or required user work-arounds. The PM, user representative, operational tester, and operational evaluator, at a minimum, participate in the OTRR. Other organizations participate at the invitation of the evaluator and tester organizations. The security accreditation agent, IV&V agent, and developmental evaluator participate if needed.

(2) Part Five of DA Pamphlet 73-1 provides the OTRR procedure and sample agenda. The acquisition

category, system complexity and interest level determine the extent and formality of OTRRs. There are several OTRRs which precede the final OTRR, each with similar objectives: to provide an iterative assessment of software and system readiness for testing, and to provide an update on the readiness of the operational test planning.

9-5. Documentation

a. The evaluation plans, test plans and supporting plans must be approved and ready to support the execution of operational testing and evaluation. The level of approval for the plans depends upon the system acquisition category, approval authority and visibility (e.g., systems on the DOD oversight list are reviewed and plans for an IOT must be approved by DOD).

b. For full evaluation and abbreviated evaluation systems, the following plans are used and are approved for execution during this T&E event. The document prepared by the operational evaluator is: the test and evaluation plan (Chapters 1 and 2 of the TEP). The documents prepared by the operational test organization are: the test plan (Chapter 3 of the TEP) and the detailed test planning document (DTP or test plan IAW DOD-STD-7935A).

c. Formal (OT) including test planning and test reporting are still performed for systems that are not required to conduct independent evaluations. Documentation is less extensive, but the requirement to perform adequate testing remains constant. Major command (MACOM) level approval systems or installation approval systems must conduct operational testing to an established set of user requirements, in the operational environment, just as do the higher approval level systems. Documentation prepared by the operational tester consists, at a minimum, of the TEP, DTP or test plan IAW DOD-STD-7935A, and the test analysis report or test report.

d. The level of documentation for the operational tests varies over the life cycle. Formal operational tests will use final, validated documentation: user's manuals, end user's manuals and/or computer operation manuals, training documents, technical manuals, and continuity of operations plans (COOP or CONOPS). Systems which are independently evaluated will assess the maintainability evaluation results conducted by the PDSS personnel. Documentation such as maintenance manuals, software programmer's manuals (SPM), firmware support manuals or similar, requirements and software specifications (e.g., FD, US, SRS, IRS, SS, system/segment design document (SSDD), version description document (VDD), SPS, etc.) must be ready for PDSS. Transition plans must be completed, the supportability statement must be approved, and

configuration management plans must be in place and working.

9-6. Activities

a. Test.

(1) IOT or FOT is a system-level test performed by a test activity independent of the developer, the PM (program sponsor) or the user proponent. Other OTs are usually conducted to support developments for the users' representative or PM and do not require the rigorous independence of an IOT or FOT. When the accelerated development/fielding acquisition strategy is used, the full level of detail described in this section applies to the fielding certification IOT of the representative sample, IOT.C. Not all aspects of this section apply equally to the incremental software block IOTs that precede or follow the IOT.C as they are dependent on the functionality of each block.

(2) Characteristically, the test is executed in a realistic or live environment representative of the operational system mission, by the designated system users. The OT is conducted on the specified target hardware, in the production-representative system configuration (e.g., communications, peripherals, other system interfaces, etc.) with the software release/version to be fielded.

(3) The objective of the OT is not to exercise and observe every technical aspect of the system, but rather the entirety of the system and its planned support environment when it is deployed. The structure of the test considers elements of effectiveness and suitability (e.g., training, logistics, human factors):

(a) Training effectiveness, especially in the area of embedded software which will be used to train the users;

(b) Usability/understandability of the software interfaces by the user;

(c) Capability of the software to support the system mission;

(d) Capability of the user to recover and restore the system when malfunctions occur (e.g., maintainability);

(e) System and software documentation;

(f) User performance requirements (transaction processing time, peak processing loads and conditions, transition to mobilization processing from peacetime, combat modes, etc.);

(g) Capability of the system to perform within the accuracy required by the users as documented in user requirements (e.g., MNS, FD, ORD);

(h) Capability to support the operational mission over the time periods required (e.g., robustness, fault tolerance, reliability);

(i) Capability to operate in degraded modes (users specify the minimum functions which must be available);

(j) Capability to provide CONOPS or COOP;

(k) Capability of the system to interface and interoperate with other distinct systems as required.

(4) Software change policy during OT. Software found to be deficient to the extent that objectives of the OT cannot be met, will require a special OTRR to review the extent of modifications required, the impact of modifications on the ability of the test to meet its objectives, and the resource implications associated if the completed portion of the test has to be repeated. A software modification is allowed only if directed by the commander of the test proponent agency in coordination with the evaluation agency.

(5) Operational testing shall occur in parallel with the existing systems. If this is not feasible, a written waiver will be prepared by the PM and operational tester, and submitted to the system approval authority (e.g., MAISRC, DA). The system/software will normally be removed from the test site at the close of operational testing. A Milestone III production/deployment decision and a materiel release approval IAW AR 700-142 constitute the authority to field the new system.

(6) Metrics collected and analyzed for OT are reliability and breadth of testing. Fault discovery and closure data are analyzed using the priorities in DOD-STD-2167A, Appendix C. Further discussion of the reliability and breadth of testing metrics is in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

b. Evaluation. The primary objective of operational evaluation is to address the operational effectiveness and suitability of Army systems for use by typical users in realistic operational environments. The scope of operational evaluation does not extend to the technical aspects of the software, but rather to the ability of the software to support the operational mission of the system as a whole. Although the evaluation focuses on the critical operational issues and criteria identified in the TEMP, it is not limited to them. It provides estimates of the expected impacts upon system performance in terms of the ability to meet the mission need. Even in those situations when DT and OT are conducted concurrently, separate evaluations (TE & OE) will be performed by separate evaluation organizations. As a minimum, the following factors will be addressed in the evaluation:

(1) Capability of the software to support the system mission.

(2) System user's ability to manage the system (cycle/system set-up, and input/output control).

(3) Adequacy of interfaces with respect to loss of data handling through processing, inter-system data transfer, and two-way transmission over communications links.

(4) Adequacy of control statements to reflect the required functional order of cyclic and system processes.

(5) That system products such as reports and magnetic media have been produced, are correct, and disposition and handling instructions for these are clear and accurate.

(6) That system performance meets user-defined performance requirements as stated in the ORD and the UFD.

(7) Burden placed upon the system or operator by operator intervention requirements.

(8) Capability of the system to perform within the accuracy required by the user as documented in user requirements.

(9) Capability of the system to operate for the time periods required (e.g., robustness, fault tolerance, reliability).

(10) Capability to operate in degraded mode (user specified minimum functions).

(11) That recovery/restart procedures overcome processing malfunctions.

(12) The level of documentation is appropriate such that user personnel can comprehend and use it effectively.

(13) That file conversion procedures are adequately described and executed.

(14) That training and training materials are adequate to produce capable, competent system users/operators.

(15) Capability to provide CONOPS or COOP.

9-7. Decision criteria

a. In order for the system to successfully complete this phase, the following documentation must be complete: an approved test and evaluation report (TER). The TER is based on the test results, and any other documentation supporting the independent operational evaluator's (IOE) evaluation of the system effectiveness and suitability. It identifies how well the system met the COIC. If the system is found to be effective and suitable, the T&E findings support a production decision or software distribution.

b. Evidence of failure to meet COIC or other problems which preclude the accomplishment of the intended missions will be the basis for a decision by the appropriate decision authority and review councils (i.e., ASARC or MAISRC). Among the possible alternative courses of action are:

(1) To implement follow-on formal operational

test(s). The emphasis behind these follow-on tests will be to address the problems identified during initial operational testing.

(2) To return the program to the DT phase for significant corrective action.

(3) - To cancel the program.

c. If follow-on testing is required, the process for development of test and evaluation plans previously discussed must be re-initiated to address only those problem areas in the TER. At the completion of follow-on formal operational test, the decision authority will make a production decision based upon all information available to that body at the time, to include the recommendation of the independent operational evaluator if solicited.

d. Post-deployment software support tests are discussed in Chapters 11-16, post deployment support test and evaluation procedures, of this part of DA Pamphlet 73-1.

Chapter 10
Materiel Release for Software

10-1. Introduction

The materiel release process is intended to assure that Army materiel is suitable and supportable before it is issued to the users. The materiel fielding and transfer processes ensure the orderly and effective deployment and transfer of Army equipment, including all necessary logistic support requirements. AR 700-142 documents the Army's materiel release, fielding, and transfer processes. These processes pertain to systems as a whole, which can be comprised of either hardware, software, or both. AR 700-142 addresses and emphasizes the need to fully assess release/fielding issues relating to both constituents, and further identifies and emphasizes the software aspects. This chapter expands upon these software issues as they pertain to the release and fielding process.

10-2. Objectives

The objectives of the materiel release for issue process are to:

a. Establish a management control system to ensure that materiel released for issue by the Army is safe, operates as designated, and is logistically supportable.

b. Provide a system which enables Headquarters, Department of the Army (HQDA) to have overall visibility and control of the materiel release process.

c. Provide a mechanism to monitor, control and follow through on all conditional releases until full release is obtained.

10-3. Scope

a. Materiel subject to release actions under AR 700-142 include:

(1) First time procurements, including depot assembly programs, developmental, non-developmental and product-improved systems, and non-major systems governed by AR 25-1, AR 25-5, AR 40-60, AR 70-1, AR 70-15, AR 105-7, and AR 350-38 for which the Army has life cycle materiel management responsibility. Software that is part of a new system or is part of a hardware and/or firmware change is released as part of the prime end item.

(2) Follow-on procurements of systems which have been previously issued under full release (e.g., without a break in production of one year or more), follow-on procurements produced by a different contractor, or systems currently under conditional or training release.

(3) Conversion programs for which a change in type classification model/type occurs, or configuration changes significantly affect form, fit, or function.

(4) Changed software, to include embedded, proprietary, and NDI software that meets one or more of the following criteria:

(a) Software that significantly changes (or has the potential to change if not adequately tested) mission function, capability, performance parameters, interoperability requirements, reliability or safety.

(b) A block update consisting of a software change of more than 30% executable lines of code (LOC) or 30% executable cumulative LOC changes not having required release approval since the last materiel release. These criteria may be tightened at the discretion of the MATDEV based upon the criticality of the software changes.

(c) A block update consisting of a software translation of 30% LOC to a different computer programming language.

(d) Deployable system integration software, which is newly developed software added to NDI software necessary to allow customization and interoperability, or simply to integrate multiple NDI software items so that they work together under one "system."

(e) Software that is significantly changed to run on a different computer processor.

(f) Software changes that require new user-level test equipment and/or impact 25% of the program of instruction.

(5) All associated support items of equipment (ASIOE) and ancillary equipment comprising the total materiel system.

(6) Stand-alone or embedded automatic data processing equipment (hardware and software) including automated test equipment (ATE), deployed to the user MACOM.

(7) Materiel manufactured by a second source.

(8) Equipment subject to mission support plan (MSP) for which IERs/IARs are required.

b. The process as discussed herein applies to the materiel discussed in paragraph 10-3a above, with the following special provisions noted:

(1) Materiel developed by the Army, procured by the Defense Logistics Agency (DLA), and distributed by the Army requires a materiel release action.

(2) For materiel developed by the Army and assigned to the DLA or the General Services Administration (GSA) for procurement and distribution (integrated materiel management), the Army MATDEV will establish a memorandum of understanding/agreement. All necessary technical and logistical support will be provided to DLA or GSA to assure distribution of the materiel.

(3) For materiel developed by the Army for another service, federal agency, or foreign government, the criteria specified in the agreements between the Army and the user or developer will govern the materiel release process. To the extent that those criteria are not defined, the criteria in AR 700-142 will apply.

(4) Security assistance programs may be waived from the instruction specified herein to accommodate the terms of an agreement or when requested by the customer.

10-4. Materiel release policy

a. Materiel approved for release must be safe, operationally effective, operationally suitable, and logistically supportable.

b. The lead MATDEV responsible for fielding the prime end item of a materiel release system is also responsible for ensuring the availability of the support equipment, to include materiel system computer resources, initial support resource, ammunition, and ASIOE.

c. Materiel proposed for release will remain under the control and accountability of the materiel developer until the release approval is granted. Materiel may be pre-positioned before materiel release is approved, but the final transfer of accountability and control to the user will occur only after release approval is obtained. Materiel release requests should be initiated approximately 180 days prior to first unit equipped (FUE) or hand-off date to allow materiel release approval. The materiel release decision should occur by 120 days prior to first unit equipped delivery (FUED) to prevent turbulence in the materiel fielding process.

d. The type of release (full, conditional or training) is determined after a comprehensive assessment of the total materiel system (see DA Pamphlet 700-142). If any ASIOE is conditionally released to the lead MATDEV, the materiel system release must also be conditional.

e. The existence of a safety deficiency in a system does not preclude full release of the system in cases where the Army Acquisition Executive (AAE) or the AAE designee has accepted the associated risk. Acceptance of the risk is documented in the system safety risk assessment.

f. Prior to the release decision, the MATDEV will provide the logistician, user's representative, and other participants in the Materiel Release Review Board (MRRB), a copy of the documentation showing that the materiel release (training, conditional, or full release) pre-requisites have been met.

10-5. Types of materiel release

Materiel release falls into one of three categories: full, conditional, or training. These are discussed below:

a. Full release. A full release is authorized after the materiel has been tested and evaluated, and determined to meet all established requirements. The user MACOM must also concur with the final materiel fielding plan, and all other aspects of the logistics support system must have been achieved as specified in the integrated logistic support plan (ILSP) approved at the Milestone III decision review. In addition, validated and verified draft DA equipment publication (or authenticated commercial manuals), and all classes of supply and sustainment materiel must be available prior to or concurrent with fielding.

b. Conditional release. A conditional release may be authorized when one or more of the criteria for full release have not been met. If an urgent need exists for the materiel, a conditional release may be granted as long as the hardware and/or software is available and acceptable to the user MACOM (requires general officer acceptance), and if an interim means of support exists. However, a conditional release requires that a get-well plan (for each condition that precluded a full release) be developed and approved, and that the conditional release be restricted to a specific quantity, location, and application. Requests for conditional release of DOD major and defense acquisition program (DAP) materiel systems will be sent through HQDA (DALO-SMS) to the Vice Chief of Staff, Army (VCSA). Status must be reported periodically until all conditions are satisfied and full release is realized.

c. Training release. Training release is the release of materiel to TRADOC or a TRADOC-sponsored school for training use only. Prior to approving training releases, the MATDEV will ensure that critical issues such as safety, availability of spare/repair parts, technical documentation, responsibility for maintenance support, and other conditions which limit use of the item are identified and accepted by the trainer.

10-6. Procedures for materiel release

Full and training releases are approved by the MSC upon completion of the materiel release process as described in the preceding paragraphs. A copy of the approval document is provided to HQDA. Requests for conditional releases of ACAT, and Director, Operational Test and Evaluation (DOT&E) oversight materiel systems are forwarded through HQDA to the VCSA for approval, with the exception of AMC-sponsored systems which are approved by CG, AMC. Requests for conditional releases

of the remaining IPR programs are approved by the MATDEV/AMC. All requests for conditional release must document gaining MACOM (general officer) acceptance for the conditions of release.

10-7. Documentation for materiel release
To ensure that the objectives of the materiel release process are met, strict documentation must be prepared and submitted for release approval. AR 700-142 details the scope and preparation, but as a minimum the materiel release documentation should include an independent evaluation/assessment from the developmental and operational evaluator/assessor, confirmation of the safety assessment, statements of supportability (for each hardware/software major constituent), confirmation that all aspects of the logistics support system plan agreed to at the Milestone III decision have been achieved, and a signed materiel fielding agreement. Of significant note is the requirement for documentation of all software supporting data, especially for re-releases necessitated by software modifications/ upgrades. If the materiel release is conditional, also included is a statement from the MACOM user accepting all conditions for release, along with general officer concurrence from the gaining command.

Chapter 11
Identification of Needs and Development of Concepts in PDSS

11-1. Introduction

a. Post-deployment software support (PDSS) consists of modifications and maintenance of software in fielded systems or systems to be fielded after MS III decision. The development of a change follows the same basic life cycle process as a new system; however, the scope and resources involved may be reduced. PDSS usually is the longest part of the life cycle. The PDSS environment generally produces many small changes over a period of time rather than a few large changes. The PDSS organization must be able to coordinate and phase-in these many changes into a few formal software releases to minimize the formal processing required and avoid any disruption in the fielded system. Differences in the magnitude and timing of software changes must be considered in identifying the scope of T&E required and the extent of T&E team involvement. The concepts of block changes and block releases must be integrated into the T&E planning. In addition, the PDSS organization may be involved in one of two capacities: as the actual software change developer, or as the PM of a contracted software change development. In both cases, the scope of the T&E required must be selectively tailored for each situation.

b. For purposes of this part of DA Pamphlet 73-1, PDSS test and evaluation refers to changes made to the system after first unit equipped (FUE) or first site fielded. These changes are within the authority of the system manager or MATDEV. Test and evaluation of changes during PDSS and software development activities mirror those detailed in Chapters 5, 6, 7, 8, and 9.

c. PDSS requires some flexibility in development, testing, and evaluation in order to respond to the changing environment. Often, new requirements have date-driven implementation milestones which must be accommodated to preclude adverse impact on system performance. Emergency changes which must be completed within 48 hours may be required. The T&E team must be responsive and is an integral element of effective PDSS support and fielding of quality products.

11-2. Requirements generation

a. Software changes to deployed systems are generated because of latent defects, doctrinal requirements, threat changes, weapon/munitions upgrades, interoperability requirements, product improvements and new system functions. Change requests are normally generated by the using agency, CBTDEV, or FP and forwarded for approval, prioritization and implementation. Changes are generated and processed in

accordance with AR 25-3, AR 71-9, AR 70- 7, AR 70-15 and DA Pamphlet 25-6.

b. Emergency changes frequently need to be released to the field within 48 hours. In this case, the T&E team needs to respond quickly to ensure that the software changes are made and adequately retested. The user representatives need to respond quickly to verify the fix (usually in the lab) and monitor the fix once it reaches the field. A good library of test cases, test data, and adequate test instrumentation is very important. Because changing software to fix a problem can introduce additional problems, retesting (regression) must be done along with testing the fix. It is permissible for formal documentation updates (e.g., design documents) to catch up later. All changes to the software must be identified and controlled by the configuration management function. Changes to documents that are required for field operation of the changed software must be developed and provided with the changed software. Identification and formal processing of all changes must be accomplished as soon as possible, but the formal publication of some support items may be deferred until the next planned block change. Emergency changes such as this will be further tested as part of the next planned software/system change package or materiel change.

c. While all changes for systems under development must undergo validation and verification testing, emergency changes to deployed systems may not require formal developmental testing or operational testing. However, all emergency changes will undergo formal testing with the next planned updates. The system/operations manager, with the concurrence of the system user, may only be capable of performing limited testing of emergency software corrections prior to granting release.

11-3. Configuration Control Board (CCB)

Specific software change requests are documented on ECP-Ss. Change packages are approved and scheduled for implementation by the appropriate configuration control board IAW DOD-STD-480B. Configuration management, software release control, and version updates are further explained in detail in Chapters 3, 6, and 7.

11-4. Software change package

a. Individual software changes, documented on ECP-Ss, are categorized based on the urgency of implementation IAW DOD-STD-480B (emergency, urgent or routine). Changes are also classified as priority 1 through 5, in accordance with DOD-STD-2167A, Appendix C, relative to the impact on operational mission effectiveness. The extent and criticality of the change to the mission coupled with the urgency of

delivering the change to using agencies may dictate the extent and thoroughness of the test and evaluation effort.

11-5. Requirements documentation updates
Requirements that drive changes to deployed software originate from many sources: new concepts and doctrine, software problem reports, quality deficiency reports from users, changes to interfacing systems or materiel changes in the system hardware. The user representative analyzes these sources and documents requirements for changes in ECP-S. Ultimately, the CCB agrees to a packages of changes derived by the MATDEV from ECP-Ss and documented in Materiel Change Information Reports (MCIR), ECPs, and other change packages. Changes that affect only the product baseline will generally require changes to the design and test documentation, but will not require changes to the requirements documents. Changes to the functional and allocated baselines will require changes to one or more requirements documents, such as the UFD, the system/segment specification, software specifications, interface specifications, and data base specifications. Test documents requiring update/development are the test plan, test description or conditions, test procedures, TDP, and TEP.

11-6. Determining the scope of T&E for changes
a. During development, all T&E functions are performed by the developer. Government agencies may witness these tests to the extent possible on a non-interfering basis. The formal acceptance testing by the developer will be witnessed by Government representatives. Chapter 4 describes the role of the T&E team members. While these may be abbreviated (or sometimes in the case of independent evaluators, not required), the roles and responsibilities are similar.
b. Developmental and operational testing brings a variety of organizations into the test process. The test director's role is carried out by the assigned tester designated IAW AR 73-1. Testing will be performed by user personnel who have practical operational experience in the functional area. Support is provided by the proponent and the materiel developer. For specialized operational testing which is required, testing may be done solely by the user, without a test director, with limited support from other agencies.
c. For major changes, which generate issues and criteria documented in the TEMP, separate evaluators may be designated IAW AR 73-1 for testing the change. The functional proponent may be directly involved and MACOM representatives may test and formally accept changes for implementation within their commands.

d. Test and evaluation activities during PDSS need to assure that software meets requirements, does not impair existing functionality or performance, can be employed by the users, and is effective and suitable. Chapters 12 through 16 discuss a formalized process for T&E that covers the major blocked changes for which significant T&E is programmed. All changes must go through software development tests, a system developmental test and some form of operational testing. The scope and significance of the changes will determine the formality of the T&E events, such as reviews. In all cases reviews are recommended, but may be less structured and less formal than those for major changes. The emphasis is on the types of T&E events that should occur.

e. MSCR and AIS changes require consideration for independent operational testing IAW AR 73-1 and AR 70-15. The following criteria will be used to determine if independent operational testing will be required for changes in computer resources (hardware, software, firmware, communications):

(1) Changes in computer resources which have a physical impact on either the operation or supportability of the system.

(2) Changes which have a noticeable impact on the system operational effectiveness and suitability, affect user interfaces or impact critical mission functions. Critical mission functions are those system functions which have a significant impact on the ability of the system to perform a required mission, or impact the defined COIC.

(3) Changes that have been made since the system was last subject to independent operational testing and which cumulatively affect at least 15% of the computer software units of the system. Software changes include those which involve changes to data relationships among computer software units, content of source or object code, or other relevant measures.

f. The intensity of independent operational testing which is recommended by OPTEC reflect the level of change to the computer resources. Recommended test approaches include the use of combined DT and OT, innovative operational tests and a strategic subset of the original test protocol. The objective is to verify that system operational effectiveness and suitability have not degraded. For system computer resources which do not meet the criteria in paragraph 11-4e, a waiver request may be submitted by the program sponsor or PEO. Waiver approval is required by the user representative (CBTDEV or FP) and the system or materiel change approval authority. Some of the factors considered in determining whether independent operational retesting is necessary are shown in Figure 11-1. Some or all of these may be affected by changes made to software.

1. **Function (purpose) of system.**
   a. Did any functionality change?
   b. Did or should COIC or Additional Operational Issues and Criteria (AOIC) change?
   c. Does the demonstrated performance change?
   d. Does the mission, OMS/MP, MNS/ORD or means of employment change?
   e. What is the potential for creating flaws or uncovering flaws?
   f. Does the change involve expansion of the system into a new functional area?
   g. Is a degradation in performance anticipated?
   h. Is there a change in throughput greater than 50% of design throughput?
   i. Is personnel safety or system survivability affected?
   j. Have the modifications affected the level of the software's criticality to the achievement of the required operational performance requirements?

2. **Testing.**
   a. Did or should the operational Measure(s) of Effectiveness (MOE) or Measure(s) of Performance (MOP) change?
   b. Does the change create a new representative sample (modification causes the modified block to become the most stressful for system performance)?
   c. Is a new stimulator, simulator, or emulator required for test purposes?
   d. What are the software test and evaluation methodologies and histories, including requirements testability, test completeness, test coverage, adequacy of test cases and procedures, and retest completeness?
   e. Have there been changes to the Failure Definition/ Scoring Criteria (FD/SC)?

3. **Interface.**
   a. Does the interface with any other system change?
   b. Is there change in system performance caused by execution or management of slave units or network management?
   c. Are protocols for communication links affected?
   d. Are there changes in the input or output domains?
   e. Are there changes in databus throughput?
   f. If the changes were made in High Order Language to Levels 1, 2, and 3 software, what is the impact of the change on related CSUs, CSCs, and CSCIs and the interfaces among the related CSUs, CSCs, and CSCIs?
   g. What is the impact of the modification on hardware/ software interfaces?

4. **Manpower, personnel, and training.**
   a. Do current Programs of Instruction (POIs) of operators or maintainers change?
   b. Is there a change in Manpower Requirement Criteria (MARC), Basis of Issue Plan (BOIP), or Qualitative or Quantitative Personnel Requirements Information (QQPRI)?
   c. Does the operator's manual or technical manual(s) change?
   d. Does the change affect training drivers or systems?

Figure 11-1. Independent Operational Retest Factors

Conversely, in some cases, a change to one or more of the factors may require the software (and system) to be retested. An example of this is using the system in a

5. **Support of system.**
a. Is there a change in PDSS maintainability?
b. Is there a change in the intended environment (particularly with respect to temperature or vibration?
c. Are there changes in support facilities (e.g. space, power requirements)?
d. Does the change affect Built in Test (BIT) or Built in Test Equipment (BITE)?
e. Does the change affect reliability, survivability, or vulnerability?
f. Is there a change in frequency of substantial problems during deployment as a result of a change in reliability, survivability, or vulnerability?
g. Is configuration management adequate (e.g. is the version of the software known; a letter of certification from the PM)?
h. What is the SEE metric rating of the system developer?
i. What is the method for physical delivery and update of the software, and how mature is the method?

6. **Internal to system itself.**
a. Does the change affect the way the system operates?
b. Does the change involve a change in the architecture of the system?
c. Is there a change in throughput with respect to efficiency or validation of the compiler?
d. Are there increased memory assignments for the link-edit function?
e. Are distributed processing or database integrity affected?
f. How many patches to the software are there in the system?
g. Did the modification include recompilation to integrate assembly language patches?
h. Did the modifications involve tools or products that were different from those used originally to develop the system? What was the maturity of and what was the software developer's experience with the tools and products used to make the modifications?
i. What is the interdependence, before and after the modifications, among CSUs, CSCs, and CSCIs?

Figure 11-1. Independent Operational Retest Factors (Cont'd.)

manner that is not the same as the way it was originally designed. A change in COIC could cause this condition.

11-7. T&E considerations for emergency changes

a. When urgency, limited test requirements, or limited resources dictate that special considerations be given to a test effort, special T&E considerations are required. Some special test and evaluation methods are:

(1) Combining developmental and operational tests. If test objectives can be satisfied combining the independent tests, they should be combined IAW AR 73-1.

(2) Supplemental site testing (SST). When all configurations of targeted hardware do not exist at one

site, supplemental testing at sites that have the required environment may be necessary.

(3) Lead site verification test (LSVT). When limited testing is required, a lead site may be selected to validate software changes. This method of testing is usually used to verify interim/emergency changes. The selected test site may be a site that reported the software problem that is being corrected, or may be any other appropriately selected site.

(4) Functional verification test (FVT). This also is intended to be a rapid verification that quick changes meet the user's requirements without degrading baselined processing.

(5) Abbreviated verification test. This test may be conducted by the software developer with appropriate T&E community witnesses and may consist of selected procedures and test items that verify specific changes. Limited regression testing will also be conducted. This type of testing is used to validate interim/emergency change packages and is usually supplemented by SST, LSVT, or FVT.

b. Developer testing will be conducted on all changes that are to be incorporated into a revised baseline. Considering the nature of the change and the required turnaround time, the MATDEV determines the amount, extent and level of developmental testing. Operational testing is decided as outlined previously in paragraph 11-6e.

c. The commander of the MATDEV activity releases emergency software updates through the configuration manager.

d. As indicated in paragraph 11-2b above, incorporation of the emergency release is required in the next software change package (SCP) or planned block change.

11-8. Test design and regression testing for PDSS changes

Test designs for all testing during PDSS shall be structured to ensure adequate test coverage for the new software changes and adequate retesting to ensure that fixes have not degraded existing functions. Adequate test coverage during development means that: (1) every specified requirement is addressed by at least one test, (2) test cases have been selected for both "average" situations and "boundary" situations, such as minimum and maximum values, (3) "stress" cases have been selected, such as out-of-bounds values, and (4) test cases that exercise combinations of different functions are included. Retesting, called regression testing, as a minimum should include repeating a subset of test cases and test procedures after software corrections have been made to correct problems found in previous testing. Retesting is complete if: (1) all

test cases and test procedures that revealed problems in the previous testing have been repeated, their results have been recorded, and the results have met acceptance criteria, and (2) all test cases and test procedures that revealed no problems during previous testing, but are test functions that are affected by the corrections, have been repeated, their results have been recorded, and the results have met acceptance criteria.

11-9. System post-deployment review (SPR)
The system/operations manager or PM should plan to conduct one or more SPRs during PDSS to determine how well the system functions. The SPR is conducted at least once, approximately six months after all initial units are equipped or all site installation is completed. This review should assess how well the operational system is satisfying user requirements in relation to meeting the stated mission. In addition, the review should assess the degree to which the system operates as the user understands or expects it to provide. Results of the SPR are used by the MATDEV to identify areas and changes that will improve system performance and usability. Additional reviews throughout the deployment and operations phase provide assurance that the system changes continue to satisfy user needs and improve the overall quality. Content of the reviews is dictated by the initial system corrective actions, problem areas and changes.

Chapter 12
Development Definition and Design During PDSS

12-1. Introduction

Test and evaluation personnel should participate in all software related reviews, such as the Software Specification Reviews (SSR), Preliminary Design Reviews (PDR), Critical Design Review (CDR), and the Test Readiness Review (TRR). As during development, it is imperative that T&E personnel understand what baselines are changed, what software processing may be impacted by changes, how the changes will affect current inputs/outputs and finally, what expected results and benefits derive from the new changes. This information better enables the T&E community to develop plans and procedures that thoroughly test the revised software. During preliminary design, focus is placed on high-level implementation of each requirement. The T&E community should use this opportunity to formulate independent evaluation plans, issues and criteria, test cases and test conditions. At detailed design, the T&E community gets the critical details necessary to develop in-depth test procedures and test items. These procedures or items are used during execution of formal testing and the results form the basis for the test report.

12-2. Documentation changes during design

Problems or changes encountered in the design effort may require changes to the requirements documents. All changes to baselined documents require formal processing and approval within the configuration management system. The preliminary updates should be closely monitored to ensure the incorporation of measurable and testable statements, definitions and criteria. These documents are further updated and finalized during detailed design, resulting in revised baseline documents that must be submitted for CCB approval. The revised and approved documents constitute the new baseline, which is placed under configuration management. The design reviews and events described in Chapter 6 are repeated. The scope and complexity of changes dictate how involved or abbreviated those activities are. Developers, SQA, IV&V, software engineers, user representatives, and T&E personnel are encouraged to use informal action officer walk-throughs to work through the technical and functional aspects of the design in relation to the stated changes.

12-3. Test and evaluation documentation

a. T&E documents generated during PDSS must be the result of:

(1) Comprehensive reviews of existing T&E plans.

(2) Assessment of the proposed software change package for new requirements.

(3) Assessment of the software change package for corrections to existing functions.

(4) Review of existing baseline, test cases, test scenarios, files, job control language (JCL), benchmark files, etc.

b. Based on comprehensive reviews of the above information, the T&E community should update previous existing test packages to ensure adequate test procedures are generated to sufficiently test all new requirements and corrected software.

12-4. Test and evaluation activities

The test and evaluation activities which occur during this phase are described in Chapter 6. This includes the reviews, audits, configuration management practices, metrics collected and analyzed, user demonstrations to check implementation of requirements in the design, and entry/exit objectives. These activities are required by DODD 5000.1, DODI 5000.2, DODD 7920.1, DODI 7920.2, and AR 73-1. Continuous evaluation, tracking of metrics and consistent T&E feedback provide the system/operations manager or PM with the tools to manage risk and make informed decisions.

12-5. Responsibilities

Responsibilities for PDSS test and evaluation activities are provided in AR 73-1, AR 70-15, and AR 25-3.

Chapter 13
Software Development T&E During PDSS

13-1. Introduction

a. The difference between the PDSS T&E process and the development T&E process is that the primary focus of PDSS testing and evaluation is on the specific changes and/or additions, along with their effect on the software system. The activities involved during coding through developer test will be addressed, along with the types of documents required for each activity. Depending upon the extent of changes, updates to existing test cases, data files, software specifications, etc., efforts in the documentation area concentrate on adding the changes and updates, not on generating new documents.

b. In an iterative fashion, the design and code are developed. The related user and requirements specifications, interface documents, design documents, functional description, test plans (not procedures) and preliminary procedures should be updated and approved IAW the stated CCB package, engineering change proposals (ECPs), and engineering change proposals-software (ECP-Ss).

13-2. Coding and Unit (CSU)/module test

a. Introduction. This section discusses the activities involved during coding and unit (CSU)/module level testing.

b. Documents. The documents listed in Table 13-1 are updated and/or developed during coding and unit (CSU)/module testing. Documents should generally require updating not complete development.

Table 13-1. Coding and Unit (CSU)/Module Test Documents During PDSS

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	SDFs	In Process	Program folders	None
	STDs	Updated, new test cases	Software test cases/procedures, test plan & procedures	Updated, new test cases
	STRs	In Process	Problem reports	None

c. Test activities. See Chapter 7, paragraph 7-2.

d. Evaluation activities. See Chapter 7, paragraph 7-2.

e. If applicable, the developer is responsible for the SDFs or program folders and their contents. Evaluations of the folders are usually conducted by an independent organization or management structure separate from the software developer (i.e., usually the Government's SQA organization). Updates to published system documentation and training packages are not normally available at unit/module level testing. Documentation available should be reviewed.

f. Metrics. Metrics collected and analyzed are shown in Chapter 7, Table 7-1. Detailed instructions for metrics collection and analysis are in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

13-3. CSC/program integration and test

a. Introduction. This section discusses the activities involved during CSC/program level testing. During this level of testing, the developer integrates the modules into programs or the computer software units into CSCs. Unit level or module level testing must have been successfully completed prior to CSC level testing. All CSCs/programs should accept [illegible] inputs and produce correct outputs. Integrat[illegible] this level needs to consider the regression t[illegible] factors described in paragraph 11-8 of Chapter 11.

b. Documents. The documents listed in Table 13-2 are updated or in process during CSC/program level testing.

Table 13-2. CSC/Program Integration Documents During PDSS

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	SDFs	In Process	Program Folders	None
	STDs	Updates	User Manual (UM)	Updates
			End User Manual (EM)	Updates
	STRs	In Process	Problem Reports	None

c. Test activities. See Chapter 7, paragraph 7-3.

d. Evaluation activities. See Chapter 7, paragraph 7-3.

e. Metrics. Metrics collected and analyzed are shown in Chapter 7, Table 7-3. Detailed instructions for metrics collection and analysis are in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

13-4. CSCI/cycle/subsystem test

a. Introduction. This section discusses the activities involved during CSCI/cycle/subsystem level tests. During this level of testing, the developer integrates programs into subsystems or the CSCs into CSCIs. Regression testing considerations apply as described in paragraph 11-8 of Chapter 11. Program or CSC level testing must have been successfully completed prior to CSCI/subsystem level testing.

b. Documents. The documents listed in Table 13-3 are updated or in process during CSCI/cycle/subsystem level testing.

Table 13-3. CSCI/Cycle/Subsystem Documents During PDSS

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	SDFs	In Process	Program Folders (PFs)	None
	STDs	Final Update	UM	Updated
			EM (if applicable)	Updated
	STRs	In Process	Problem Reports	None
	Program Maint. Manual	Updated, Final	Maintenance Manual	Updated, Final
	SPS	Updated	Computer Operation Manual (if applicable)	Updated
	VDD	Draft	VDD	Draft
	Software Test Report	Final	Test Analysis Report	Final or in process (updated when system level test completed)

c. Test activities. See Chapter 7, paragraph 7-4.

d. Evaluation activities. See Chapter 7, paragraph 7-4.

e. Metrics. Metrics collected and analyzed are shown in Chapter 7, Table 7-5. Detailed instructions for metrics collection and analysis are in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

13-5. System test

a. Introduction. This section discusses the activities involved during system-level tests. During this level of testing, the developer completes integration of software with software and hardware to form the system. Cycle or CSCI testing must have been successfully completed prior to system testing.

b. Documents. The documents shown in Table 13-4 are updated during system level testing.

Table 13-4. System Test Documents During PDSS

Primary Responsibility	MSCR Products	Condition of Document	AIS Products	Decision Criteria
Software Developer	SDFs	In Process	Program Folders	None
	STDs	Final Updates	Software test procedures in PT	Final Up
			UM (if applicable)	Final Update
			EM (if applicable)	Final Update
	STRs	In Process	PRs	None
	SPS	Final Update	Computer Operation Manual (if applicable)	Final Update
	Program Maint. Manual	Final Update	Maintenance Manual	Final Update
	VDD	Final	VDD	Final
	Software Test Report	Final	Test Analysis Report	Final

c. Test activities. See Chapter 7, paragraph 7-5.

d. Evaluation activities.

(1) System level testing concludes with the tester preparing a test (analysis) report. The test (analysis) report will be forwarded for review by the PM and the developmental and operational testers. This final developer's test (analysis) report forms a portion of the basis for the system/operations manager to prepare the DTRS and conduct a DTRR to enter the next test phase.

(2) The developer concludes system test activities by updating the source code and design documentation, resolving the STRs or PRs and preparing

the test report. System tests may be Government witnessed software acceptance tests to demonstrate that the development testing has met the software specifications (CCB package, ECP-Ss, etc.), and that the changes have not impaired the performance or features. It is particularly important for the Government to witness the system test when the development is done by contractors, not Government personnel. Usually by contract the software and associated products are formally accepted by the Government and there must be evidence that requirements are met IAW the contract.

e. Metrics. Metrics collected and analyzed are shown in Chapter 7, Table 7-7. Detailed instructions for metrics collection and analysis are in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

Chapter 14
System Developmental Test and Evaluation in PDSS

14-1. Introduction

During this phase of the process, the tester controls the T&E process. The software baseline is frozen for this phase of testing in order to maintain data consistency. The baseline is not modified during this phase of testing, unless severe problems are encountered. If the baseline is modified, regression testing is required, IAW paragraph 11-8 of Chapter 11, to ensure detected problems were corrected and additional problems were not introduced into the software. Test and evaluation objectives, functions and responsibilities parallel those described in Chapter 8, System Developmental Test and Evaluation, but are usually abbreviated based upon the number, magnitude and complexity of modifications. Excessive priority 1, 2, or 3 software problems discovered during testing may cause suspension or termination of testing. Termination or suspension is IAW AR 73-1. The system developmental test and evaluation described here is the same as the PDSS Test of Part Four of DA Pamphlet 73-1.

14-2. Entry objectives

a. Evidence of successful completion of developer's tests, formal and informal, consists of a test analysis report, developer test documentation (e.g., updated test plan and procedures, STRs or ECP-S generated), QA configuration controlled software baseline, baseline name and version identifiers. Preferably, there should be no open priority 1 or 2 problem reports or incident reports from previous testing. Serious consideration and severe test limitations may result if DT occurs with open priority 1 or 2 problem reports. It may cause DT to be repeated due to invalid data. Status of these are discussed at the DTRR (see Chapter 8) conducted by the system/operations manager or PM.

b. Documents include an updated IEP if independently evaluated, either a TDP and DTP, or PT. The system documentation (e.g., user's manuals, updates to VDD, implementation instructions, changes to technical manuals) for the change package will be in final form.

c. A DTRS is reviewed and finalized during the conduct of the DTRR to certify readiness to begin the developmental testing. The DTRR is conducted by an organization other than the developer. In some cases this may be a QA organization, the PM, the operational manager, an IV&V agent, or other Government agency.

14-3. Activities

a. System test

(1) DT verifies system performance to determine if any changes to the code have introduced additional problems to existing software, or performance has been adversely impacted. Additionally, volume loads, stress levels and interfaces, and system interoperability and interfaces are tested. Benchmark test files, copies or production files and test cases entered by users constitute the test data based upon the ECP-S or other change package. Testing will not be run in a live production environment, but will be run in parallel. If this is not feasible, a waiver must be obtained from the approval authority for that level of system.

(2) The tester will coordinate all activities with the PM and provide guidance for the resources required to support testing. At the beginning of DT activities, updates to computer operation and user's manuals, conversion documentation, VDD and training package materials will be in final form and will be used in the execution of the DT processes.

(3) The tester updates existing test plans and test cases based upon the ECP-S to ensure that the existing functions work and new requirements are stated.

(4) Well-defined requirements are necessary to develop the test plan for all evaluation issues. These requirements will allow testers to tailor the generic test areas to the specific software application.

(5) If an independent developmental evaluator is designated, he shall monitor the test, but not participate as a test director. The developer is not to participate in this, unless requested by the tester when difficulties occur.

(6) Problem reports are generated for system/software anomalies found during DT. Problems are reported in a TIR, PR, or STR. Software problems are categorized and prioritized IAW DOD-STD-2167A, Appendix C. Problem report forms often have a developer's analysis section which is used for corrective action reporting.

b. Evaluation

(1) Results of testing are scored by a review board. The user representative, developmental evaluator if applicable, and developmental tester are principal board members. Test results are evaluated by the developmental evaluator/assessor or tester IAW the test plan.

(2) Tests are structured to ensure that all capabilities and requirements of the system modifications are exercised and analyzed IAW the requirements stated in the ECP-S and other documents. Elements of the developmental evaluation/assessment may include but are not limited to the following:

(a) Software performance -- determine how well the software supports system performance. Examples of performance issues are:

- Control statements adequately reflect the required functional order of cycle and
- system processing (e.g., files passed between cycles).
- Performance results are evaluated to ensure that response time, run times, memory and peripheral equipment utilization, operator intervention requirements, and overall operating characteristics are analyzed. This information will be used to determine potential adverse system impacts and possible performance bottlenecks as well as significant benefits.
- Recovery/restart procedures are evaluated to ensure that users can overcome potential processing malfunctions.
- Test results are fully evaluated to ensure that all stated test objectives have been met, or that sufficient explanation is given for those objectives not attained and the impact on the OT or other post-DT activities.
- The conversion process is evaluated to ensure that data is transferred in a correct manner (e.g., left of baseline). A similar evaluation must also be performed for processing which generates the converted or initial database into the new system format (e.g., right of baseline). File contents resulting from the conversion process must be verified and validated according to the methodology and criteria specified in the DT test plan.

(b) Interoperability -- the degree to which data is correctly exchanged and interpreted between systems. Basically, there are two types of interoperability: intrasystem and intersystem. Examples of interoperability issues are:

- The system user is able to manage the system to include interactive terminal interface, cycle/system set-up, and input/output control.
- Interface considerations with respect to ease of data handling through cycle processing, intersystem data transfer, transmission of data over communications links, and time sharing links are functioning properly.

(c) Usability -- The effort required to learn the human interface with the software, to prepare input and to interpret output of the software. Usability

testing addresses the man-machine interface. Examples of usability issues are: system products such as terminal displays, hard copy reports, punched cards, and magnetic tape and direct access files are correct and disposition for these are clear and adequate.

(d) Training is evaluated to ensure the adequacy of appropriate user manuals, the VDD, on-the-job instruction, and problem reporting procedures, if applicable.

(e) Documentation is evaluated to ensure that appropriate personnel can comprehend and use these publications. The programmer's maintenance manuals should be updated and reviewed. Special attention should be given to those documents destined to be used by non-automated data processing (ADP), functionally oriented personnel in the operation and use of computer software systems.

(3) The developmental test report is written by the developmental tester.

14-4. Decision criteria

a. The items needed to proceed from this phase and enter operational testing are an IER, if required, developmental test (analysis) report, and successful completion of the OTRR. If independently evaluated, all independently evaluated systems produce an IER in addition to a test report. Independent evaluation is less frequent during PDSS. The IER is the evaluation of how well the system met the critical issues stated in the IEP. This evaluation should include software metrics and any other outstanding software problems. For systems which are not independently evaluated or assessed during PDSS, the tester's report shall include evaluative content.

b. For entry to operational testing, no priority 1 or 2 software problem reports can be open. In addition, software problems fixed during DT require evidence of comprehensive regression testing prior to admittance for operational testing. This includes updates to documentation and impacts of any work-arounds required. The user may require that additional software problems be fixed prior to OT.

c. Metrics collected during Government developmental testing will include reliability. Fault discovery and closure data will be collected and analyzed IAW Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

d. Exiting this phase is contingent on the responsible organizations and cognizant personnel conditionally approving moving to the next phase(s). This warrants that the documents, metrics, reviews, results, regression tests, evaluations (if required), etc., are in the condition to be used to execute the next phase.

Chapter 15
Operational Testing (OT) in PDSS

15-1. Purpose

a. This chapter defines methodology and procedures for operational evaluation and test implementation for systems which contain computer resources, during the post-deployment phase of the life cycle. Operational testing focuses on how the software supports the system mission, and the capability of the user to employ the system. If new COICs are generated, the system requires independent operational evaluation IAW AR 73-1. In these cases, software evaluation aims for successful operational testing in the operational configurations, loads, and environments; and assists in determining adequate test coverage so evaluators are confident in their assessments of operational effectiveness.

b. Operational testing is distinct from other tests. See Chapter 9, paragraph 9-1. Requirements for OPTEC independent operational testing are IAW paragraph 11-6 of Chapter 11 and AR 73-1.

15-2. Objective

The objective of operational testing and evaluation is to evaluate the extent to which the software supports, and can continue to support, the operational requirements of the user. The goal of PDSS is to ensure systems remain operationally effective and suitable.

15-3. Operational testing types

a. Operational tests and their associated evaluations, if required IAW AR 73-1 and AR 25-3, are crucial elements of the decision-maker's milestone process for decisions. OT, under specific conditions outlined in AR 73-1, may be combined with developmental testing. Combined DT/OT requires that the T&E team early-on establish their test strategies and coordinate their efforts. In all cases, a portion of DT/OT must be a dedicated OT phase. OT during PDSS is generally an FOT and may require independent evaluation.

b. Depending on the circumstances involved, any one of the types of operational tests listed in Chapter 2, Table 2-1, may be appropriate during PDSS. The most common type is FOT which will be used for most software change packages (SCPs) or (ECP-Ss). Supplemental operational tests will be used when the system under test is deployed on more than one hardware platform, or when concepts and innovative approaches will be explored. Limited user tests (LUTs) may be used when a priority 1 or 2 ECP-S is fielded in an interim change package (ICP), or for any emergency change or date-driven regulatory change.

15-4. Entry objectives

a. Operational test readiness statement. The PM or system/operations manager, trainer, and the user representative prepare OTRSs to indicate that the area for which each is responsible is prepared to enter the OT.

b. Operational test readiness assessment. See Chapter 9, paragraph 9-4.

c. Completed software technical and developmental tests, as determined by the breadth of testing metric. The tester or evaluator, if an evaluated system, ensures Government developmental testing and software development are completed. See Chapter 9, paragraph 9-4.

d. OT version description. The operational tester or evaluator may include, as part of the OT readiness assessment, the version description document (VDD) or similar description of the version of software to be tested in operational test. See Chapter 9, paragraph 9-4.

e. Software problem reports. Priority 1 and 2 software problem reports must be resolved prior to OT. The system may be allowed to proceed to OT with open problem reports (priorities other than 1 or 2) provided that concurrence is obtained from the user representatives. Work-arounds may be necessary for these open problem reports in order to avoid delaying the start of OT. However, these must be clearly specified, trained for, and accepted by the user representative.

f. Operational test readiness review. See Chapter 9, paragraph 9-4 and Part Five of DA Pamphlet 73-1.

15-5. Documentation

a. The test plans, evaluation plans (only if evaluated), and supporting plans must be updated and approved and ready to support the execution of operational testing and evaluation.

b. For major and non-major systems (except AIS Class VI and some AIS Class V IAW DISC4), the following plans are used and are updated for execution during this T&E event. The document prepared/updated by the operational evaluator and/or operational tester is the test and evaluation plan (Chapters 1 and 2 of the TEP). The documents prepared by the operational test organization are: the test plan (Chapter 3 of the TEP) and the detailed test planning document (detailed test plan (DTP) or test plan (PT)). The scope and volume of documentation for OT during PDSS may be proportionately reduced from that required during the development phase of the life cycle.

c. Operational testing, including test planning and test reporting, are still performed for systems that are not required to conduct independent evaluations.

Documentation is less extensive, but the requirement to perform adequate testing remains constant. MACOM-level approval systems or installation approval systems, AIS Class VI and some AIS Class V IAW DISC4, must conduct operational testing to an established set of user requirements in the operational environment just as do the higher approval level systems. Documentation prepared by the operational tester consists, at a minimum, of the TEP, DTP or test plan (PT), and the test analysis report or test report.

d. Operational tests will use final documentation: VDD, user's manuals, end user's manuals and/or computer operation manuals, training documents, technical manuals, COOP or CONOPS.

15-6. Activities

a. Test.

(1) OT is a system-level test performed by a test activity independent of the developer, the PM, system/operations manager, or the user community. This means that the test planning scenarios, etc., are developed by an independent activity. It is imperative that the user representatives participate in certain planning aspects and the test. Characteristically, the test is executed in a realistic or live environment representative of the operational system mission, by the designated system users. The OT is conducted on the specified target hardware, in the production-representative system configuration (e.g., communications, peripherals, other system interfaces, etc.) with the software version to be fielded.

(2) The objective of OT is not to test the technical aspects of the system, but rather the entirety of the system and its planned support environment when it is deployed. The structure of the test considers elements of effectiveness and suitability (e.g., training, logistics, human factors).

(3) Test requirements of the test plan will be exercised and satisfied prior to test termination.

(4) Software change policy during OT. Software found to be deficient to the extent that the objectives of the OT cannot be met, will require a special OTRR to review the extent of the modifications required, the impact of the modifications on the ability of the test to meet its objectives, and the resource implications if the completed portion of the test has to be repeated. Decisions to make changes to software during FOT or other post-deployment tests are the decision of the independent tester; however regression testing and additional testing will be conducted to ensure that the change works and has not impaired other functions.

(5) Operational testing shall occur in parallel with the existing system. If this is not feasible, a written waiver will be prepared by the PM or

system/operations manager and the operational tester, and submitted to the test site or local director of information management (DOIM). Following operational tests, the system/software is removed from the test site and released only through formal configuration management release channels unless the test waiver is approved; however, systems or software cannot be released to any other sites. Other sites must wait for release through formal channels.

b. Evaluation. If this PDSS change is not independently evaluated, the FP, CBTDEV, or his designated representative shall ensure the issues of effectiveness and suitability are addressed. The FP or CBTDEV shall then prepare the evaluative comments portion of the expanded test report IAW AR 73-1. Should the FP or CBTDEV elect to do so, the operational tester shall prepare an expanded test report IAW AR 73-1 with evaluative content. Operational test issues are discussed in Chapter 9, paragraph 9-6.

c. Metrics. The metric collected and analyzed for OT is reliability. Fault discovery and closure data are analyzed using the software problem priorities listed in DOD-STD-2167A, Appendix C. The reliability metric is discussed in Chapter 17, Software T&E Metrics, of this part of DA Pamphlet 73-1.

15-7. Decision criteria

a. In order for the system to successfully complete OT, the following documentation must be complete: an approved TER or OA or expanded test report (ETR) IAW AR 73-1. The TER/OA or ETR is based on the test results contained in the test report or expanded test report, and any other documentation supporting the evaluation of system or software change package (SCP) effectiveness and suitability. It identifies how well the system met the COIC or other issues. If all COICs have been addressed satisfactorily, a recommended position for materiel release is included as part of the TER/OA or ETR.

b. Evidence of failure to meet the user operational issues and criteria will be the basis for a decision by the appropriate decision authority. Among the possible alternative courses of action are:

(1) To implement follow-on formal operational test(s). The emphasis behind these follow-on tests will be to address the problems identified during initial operational testing.

(2) To return the program to the DT phase for significant corrective action.

c. If follow-on testing is required, the process for development of T&E plans previously discussed must be re-initiated to address only those problem areas in the TER/OA or ETR. At the completion of follow-on operational test, the decision authority

will make a materiel release decision based upon all information available to that body at the time, to include the recommendation of the evaluator or tester, if required.

Chapter 16
Materiel Re-release for Software

16-1. Introduction

As stated in Chapter 10, Materiel Release for Software, the materiel release process is intended to assure that Army materiel is suitable and supportable before release for issue to the users. The materiel fielding and transfer processes apply equally to modified/upgraded items as they do to new items. Particular attention must be given to modified/upgraded items, because very often they are implemented and delivered to the field without having gone through the proper assessment process - this is particularly critical in the case of software, since a small, misplaced error can cause major degradation of mission effectiveness and significantly impact safety. AR 700-142 documents the Army's materiel release, fielding, and transfer processes. This chapter emphasizes and expands upon the software issues as they pertain to the release and fielding process for modified/upgraded items and emergency materiel releases for software.

16-2. Objectives

The objectives of the materiel release for issue process remain the same during the post-deployment phases; these are to:

a. Establish a management control system to ensure that materiel release for issue by the Army is safe, operates as designated, and is logistically supportable.

b. Provide a system which enables HQDA to have overall visibility and control of the materiel release process.

c. Provide a mechanism to monitor, control and follow through on all conditional releases until full release is obtained.

16-3. Scope

a. Materiel subject to release actions under AR 700-142 are the same as those stated in Chapter 10, Materiel Release for Software. This section deals specifically with changed software which results from actions to modify/upgrade a fielded system. Changed software, includes embedded, proprietary, and NDI software that meet one or more of the following criteria:

(1) Software that significantly changes (or has the potential to change if not adequately tested) mission function, capability, performance parameters, interoperability requirements, reliability or safety.

(2) A block update consisting of a software change of more than 30% executable LOC or 30% executable cumulative LOC changes not having required

release approval since the last materiel release. These criteria may be tightened at the discretion of the MATDEV based upon the criticality of the software changes.

(3) A block update consisting of a software translation of 30% LOC to a different computer programming language.

(4) Deployable system integration software, which is newly developed software added to NDI software necessary to allow customization and interoperability, or simply to integrate multiple NDI software items so that they work together under one "system."

(5) Software that is significantly changed to run on a different computer processor.

(6) Software changes that require new user-level test equipment and/or impact 25% of the program of instruction.

b. The process as discussed herein applies to the materiel discussed in paragraph 16-3a above, with the following special provisions noted:

(1) Materiel developed by the Army, procured by the DLA, and distributed by the Army requires a materiel release action.

(2) For materiel developed by the Army and assigned to the DLA or the GSA for procurement and distribution (integrated materiel management), the Army MATDEV will establish an MOA. All necessary technical and logistic support will be provided to DLA or GSA to assure distribution of the materiel.

(3) For materiel developed by the Army for another service, federal agency, or foreign government, the criteria specified in the agreements between the Army and the user or developer will govern the materiel release process. To the extent that those criteria are not defined, the criteria in AR 700-142 apply.

(4) Security assistance programs may be waived from the instruction specified herein to accommodate the terms of an agreement or when requested by the customer.

16-4. Materiel release policy

a. The provisions stated in Chapter 10, Materiel Release for Software, remain in force during the post-deployment phase. This paragraph addresses additional procedures which are implemented at MATDEV MSCs to deal with software upgrades/modifications implemented via ECPs. The rationale for these procedures stems from repeated problems typically observed when software has been modified and issued to the field.

b. An advisory group to the Materiel Release Review Board, sometimes referred to as the MRRB Software Sub-group (SSG), can add significant emphasis on assuring the integrity of the ECP process. Made up of experienced software managers, the members of the SSG

are fully qualified to address all software issues, and are representatives from all of the cognizant MATDEV organizations including software quality assurance, software engineering, safety, and ILS. Depending on the release action to be taken, full release, conditional re-release or simply issue via ECP, the SSG can advise the MRRB or the configuration manager accordingly. Therefore, the SSG's charter fully supports the activities of the CM and can be an integral part of the configuration management process.

16-5. Types of materiel re-release during post-deployment

Re-release of software to the field can be accomplished through the materiel release process (as full, conditional, training, or emergency releases), based on the criteria stated in paragraph 16-3. If the extent of the changes, modifications, or upgrades to the software do not fall under these criteria, then typically the software is released via ECP and configuration management channels. In this case, no action may be necessary outside of the normal ECP process; however, depending on a less stringent set of criteria, the ECP may need to be accompanied by a suitability for issue statement.

a. Full re-release. A full re-release is authorized after the materiel has been tested and evaluated, and determined to meet all established requirements. The user MACOM must also concur with the final materiel fielding plan, and all other aspects of the logistics support system must have been achieved as specified in the ILSP approved at the Milestone III decision review. In addition, validated and verified draft DA equipment publication (or authenticated commercial manuals), and all classes of supply and sustainment materiel must be available prior to or concurrent with fielding.

b. Conditional re-release. A conditional re-release may be authorized when one or more of the criteria for full release have not been met. If an urgent need exists for the materiel, a conditional re-release may be granted as long as the hardware and/or software is available and acceptable to the user MACOM, and if an interim means of support exists. However, a conditional re-release requires that a get-well plan (for each condition that precluded a full re-release) be developed and approved, and that the conditional re-release be restricted to a specific quantity, location, and application. Requests for conditional re-release of DOD major and DAP materiel systems are sent through HQDA (DALO-SMS) to the VCSA. Status must be reported periodically, until all conditions are satisfied and full re-release is realized.

c. Training re-release. Training re-release is the release of materiel for training use only. Prior to approving training re-releases, the MATDEV ensures that critical issues such as safety, availability of spare/repair parts, technical documentation, responsibility for maintenance support, and other conditions which limit use of the item are identified and accepted by the trainer.

d. Emergency materiel releases for software may be required to correct serious software problems, respond to threat changes, or changing doctrine during wartime. The MSC commander can approve such fast turn-around releases. Evidence of testing, especially retesting/regression, is a necessary condition for release.

e. Suitability for issue release. The suitability for issue release is a streamlined attempt at addressing all of the critical issues necessary for materiel re-release, while avoiding the need to invoke the normal materiel release/re-release process. This is a considerable time-saver for software changes that are minor or considered "less critical," yet still provides the necessary assurance that the changes have been properly evaluated and tested. The suitability for issue release consists of a short, concise suitability statement and all supporting data. What follows is a set of criteria which can be implemented at the MACOM level as supplements to AR 700-142, to assist in determining when a suitability for issue release is required when normal materiel re-release is not. If the nature of the change is so minor that it does not even meet the criteria listed below for a suitability for issue release, then re-release is handled strictly via the ECP process. The criteria for suitability for issue release are:

(1) Change to data base to incorporate new or updated information (e.g., ballistic data, signatures, fingerprints, etc.).

(2) Change which may have significant impact on ILS (e.g., spare parts, manuals, support equipment, etc.).

(3) Minor changes to mission function, capability, performance, interoperability, reliability, safety, etc.

(4) Minor impacts to TRADOC program of instruction.

(5) Other ECP actions (reviewed on a case-by-case basis).

(a) Block updates.

(b) Translation of language.

16-6. Procedures for materiel re-release

Identification of ECP actions involving software can be flagged in a number of ways, but typically the

cognizant software quality assurance and software engineering organizations identify ECPs. They also perform the initial evaluation of the scope of the software change against the criteria in paragraph 16-3 for materiel re-release, and the criteria in paragraph 16-5 for suitability for issue release. If none of the criteria are met, then no release action is necessary beyond the normal ECP configuration management process. However, if the scope of the software change meets any of the established criteria, the cognizant organizations are responsible for making the recommendation for which release action is necessary. This recommendation is sent by memorandum to the SSG chairman who convenes the SSG for final determination. This reduces the burden on the SSG to constantly look out for software ECP actions, and keeps their involvement at a minimum. Regardless of which release action is necessary, the SSG is responsible for preparing a suitability statement and collecting all supporting data. Depending on which criteria were met, the SSG sends the suitability statement to the MRRB (for materiel re-release per Chapter 10, Materiel Release for Software) or to the CCB (for release via ECP process as a suitability for issue release. In any case, the suitability statement and support data always accompany the appropriate release/fielding documents. Figure 16-1 provides a graphical representation of this process.

16-7. Documentation for materiel re-release
To ensure that the objectives of the materiel re-release process are met, strict documentation must be prepared and submitted for release approval. AR 700-142 details the scope and preparation, but as a minimum the materiel release documentation should include independent evaluations/assessments from the developmental and operational evaluators/assessors, confirmation of the safety assessment, statements of supportability (for each hardware/software major constituent), confirmation that all aspects of the logistics support system plan agreed to at the Milestone III decision have been achieved, and a signed materiel fielding agreement. Of significant note is the requirement for documentation of all software supporting data, especially for re-releases necessitated by software modifications/upgrades. If the materiel release is conditional, then a statement is also included from the MACOM user accepting all conditions for release, along with general officer concurrence from the gaining command.

16-8. Special considerations

a. The independent tester and evaluator functions do not end with fielding/release of a software-

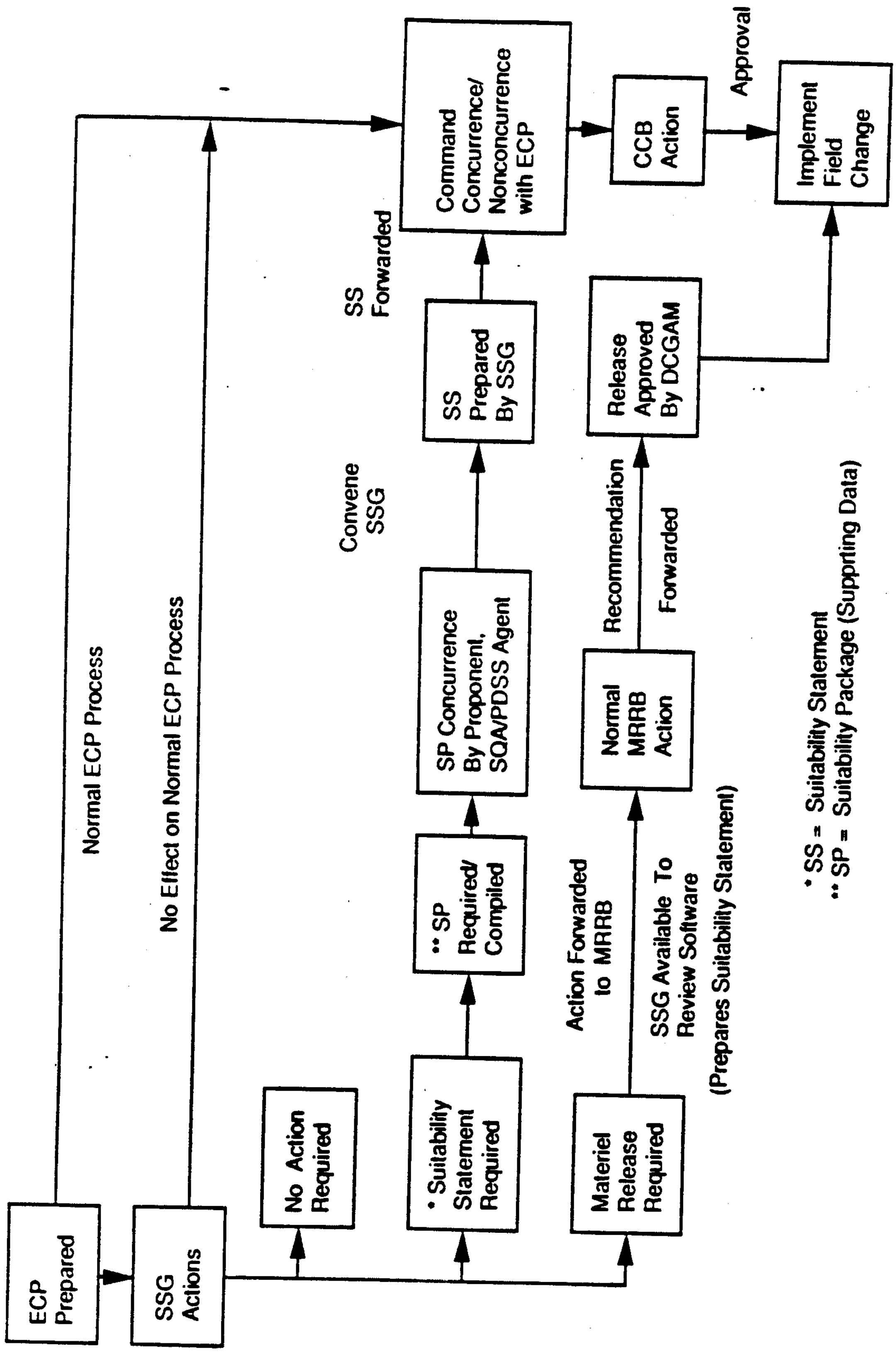

Figure 16-1. MRRB SSG - ECP Interface for PDSS Changes

intensive system. The independent evaluators must monitor production error reports to identify required modification to testbeds. Evaluation continues through post-deployment review or operational assessment. Often this evaluation will become an integral part of the mission need determination phase for re-design or replacement projects.

b. Ideally, independent evaluators stay with a system throughout deployment and operations. In reality, these functions are normally passed from a full-time evaluation agency to the system/operations manager, functional proponent, or MATDEV.

Chapter 17
Software T&E Metrics

Section I
Recommended Metric Set

17-1. Introduction

a. Per AR 73-1, "Software T&E must provide data to support an established set of qualitative and quantitative software metrics. These metrics serve as measures and indicators that critical technical characteristics and operational issues of both software and the integrated system have been achieved." The metrics described in this chapter comprise a minimum set for information gathering over the life cycle. The collection of additional metrics of specific interest are encouraged to monitor or support a particular agency's needs.

b. Many characteristics of software need to be evaluated for quality and conformance but do not lend themselves to uniform quantitative measurement. These quality factors remain important to any software evaluation. Metrics are but one of a number of software evaluation tools.

17-2. Metric set

a. The minimum set of 12 metrics is described in this section. Two additional metrics (manpower and development progress) are described in Section II as optional. These two metrics were moved out of the minimum set because they are among the most costly metrics in terms of data collection, and they are routinely collected as part of existing program development or test and evaluation activities.

b. The metrics fall into three general categories as shown in Table 17-1. Management metrics deal with contracting, programmatic and overall management issues. Requirements metrics pertain to the specification, translation, and volatility of requirements. Quality metrics deal with testing and other software technical characteristics.

17-3. Application

a. These metrics apply to systems governed by the AR 70 series of regulations and those governed by the AR 25 series of regulations.

b. Figure 17-1 shows the applicability of the minimum set of metrics over the life cycle. These metrics can provide valuable insight into a program, especially with regard to demonstrated results and readiness for test. The results of all metrics should be reported at Program Reviews, In Process Reviews, and all Test Readiness Reviews. Some of the more detailed metrics and many sub-elements of the major ones

Table 17-1. Metrics and Primary Characteristics

Metric	Objective	Measurement
Management Category		
Cost	Track S/W expenditures	$ spent vs $ allocated
Schedule	Track schedule adherence	Milestone/event slippage
Computer Resource Utilization	Track planned and actual resource use	% resource capacity utilized
Software Engineering Environment	Quantify developer S/W engineering environment maturity	Computed maturity level
Requirements Category		
Reqts Traceability	Track reqts down to code	% reqts traced
Reqts Stability	Track changes to reqts	# reqts changes
Quality Category		
Design Stability	Track design changes	Stability index
Complexity	Assess code quality	Complexity indices
Breadth of Testing	Track testing of reqts	% reqts tested, % reqts passed
Depth of Testing	Track testing of code	Degree of code testing
Fault Profiles	Track open vs closed anomalies	# and types of faults, average open age
Reliability	Assess S/W mission failures Measure down time	MTBF Restoration times

however, are not suitable for presentation at high level decision reviews such as ASARCs, MAISRCs, and Defense Acquisition Boards (DABs). Figure 17-1 also identifies the metrics which should be reported at each major decision milestone. Any other metric which indicates the potential for serious problems should

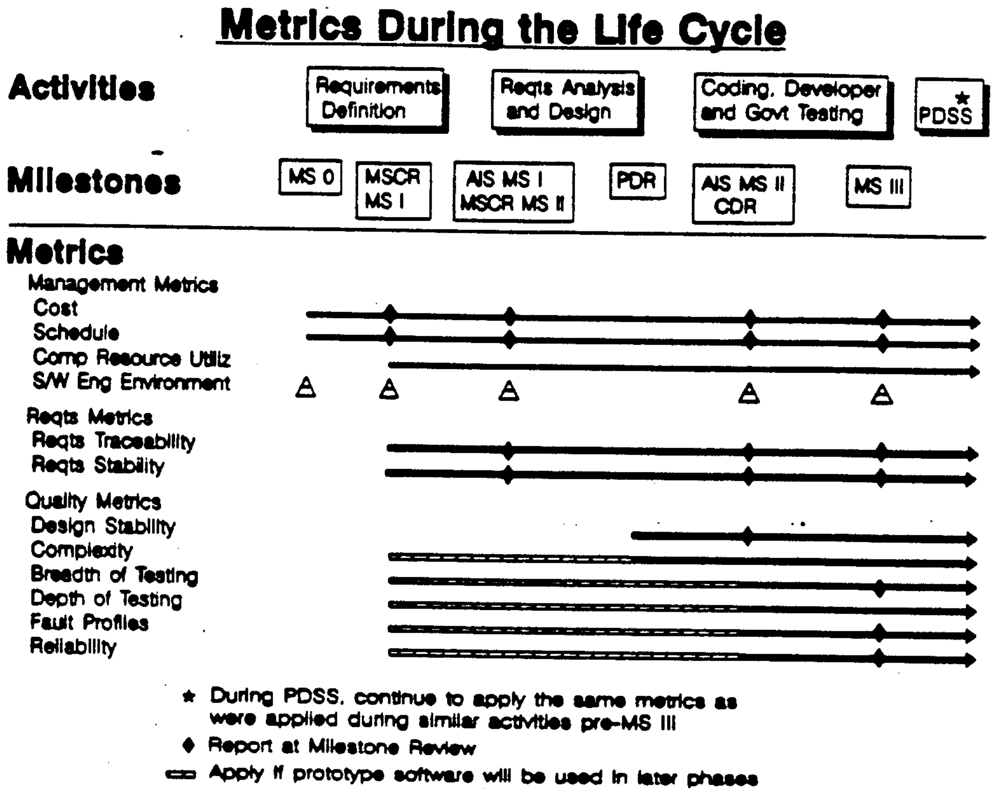

Figure 17-1. Life Cycle of Metrics

also be reported at this time.

17-4. Other considerations

a. The metric descriptions are written as if the software is being developed by a contractor. Substitute "developer" or "developing agency" when software is procured from another Army or Government agency.

b. The applicable time periods for data collection and analysis are provided with each metric description. For most metrics, data should continue to be collected after the system is fielded. Measure software updates produced through a Life Cycle Software Engineering Center (LCSEC) in a similar fashion as software in a developmental system. As a general rule, collect the same data in PDSS that was collected in similar activities prior to Milestone III.

c. The metrics should be used as program maturity status indicators. They should be used to portray trends over time, rather than placing too much importance on a calculated value at a single point in time. Trends can be studied in and of themselves, or

they can be compared with trends from similar systems that have already been built.

d. Rules of thumb for evaluating a metric are supplied when it is possible or sensible to do so. To date, there has not been widespread or consistent use of software metrics within the Army upon which to base firm evaluation criteria. As the metrics in this pamphlet become proven, validated entities, additional numerical thresholds may emerge as usable criteria. These will be added in future revisions of the pamphlet. Even as a validated set, however, the metrics remain most useful when used as trend indicators.

e. Some data requirements elements are used by more than one metric. Care should be taken that consistent data and calculations are used throughout the process.

f. The graphical displays shown in this chapter are provided for illustrative purposes. There may be other ways of processing and displaying the data that are more appropriate for a specific system.

g. Many of the terms describing the metrics and their attributes are those used in MSCR systems. Their AIS equivalents may be substituted in applying the metrics to non-theater/tactical information systems.

h. Throughout this chapter, the terms "CSU" and "module" are used interchangeably.

i. To facilitate consistent, unbiased, and automated data gathering and reporting, a survey of commercially available software tools from both Government and industry was undertaken. The data requirements in this chapter that are captured by each product are identified in the survey. The results of the study are provided as Appendix D.

17-5. Cost metric

a. Purpose/description. This metric provides insight into how well the cost of software development is controlled. It is directly analogous to the Cost/Schedule Control Systems Criteria (C/SCSC) outlined in DODI 7000.2, Performance Measurement for Selected Acquisitions, already in use to track the cost, schedule, and technical performance of hardware and weapon system developments.

b. Life cycle application. Begin data collection at program start and continue through fielding.

c. Algorithm/graphical display. MIL-HDBK-WBS.SW, Work Breakdown Structure for Software Elements, provides guidance in developing well defined work and cost accounting packages dealing specifically with software effort and materials. It amplifies the requirements of MIL-STD-881B, Work Breakdown Structures for Defense Materiel Items.

(1) The quantity and complexity of software in modern Army systems is rapidly increasing and has

become a cost and schedule driver for many systems. Development and test of software is highly labor intensive. Modern management practices utilize work breakdown structures to help provide visibility into and manage risk involved with software developments. This metric looks at the effects of several of the more volatile software work categories to assess overall progress in meeting contract cost and schedule goals.

(2) Activity types describe the type of effort associated with the collected data. Definitions for the work performed in each activity type are provided in MIL-HDBK-WBS.SW, Second Draft, dated 1 October 1991. Data on at least the following activity types should be reported and tracked:

(a) Requirements analysis
(b) Design
(c) Code and unit testing
(d) CSC(s) integration and testing
(e) Formal qualification testing
(f) CSCI integration and testing
(g) Software problem/change resolution (includes redesign, recoding, CSC(s) re-integration and testing)
(h) Software engineering management
(i) Software quality assurance
(j) Software configuration management
(k) Verification and validation
(l) Tools (see peculiar support equipment in MIL-HDBK-WBS.SW)
(m) New equipment and facilities
(n) Software data
(o) Total (The sum of items a-n above plus any other software related costs tracked or incurred by the developer.)

(3) Figure 17-2 shows a sample graph of the life cycle cost metric. The terms shown on the graph and other cost trend algorithms are defined as follows:

(a) Budgeted cost of work scheduled (BCWS) - The sum of the budgets for all work packages, the level of effort, and apportioned effort scheduled to be accomplished within a given time period.

(b) Budgeted cost of work performed (BCWP) - The sum of the budgets for completed work packages and completed portions of open work packages, plus the applicable portions of the budgets for level of effort and apportioned effort.

(c) Actual cost of work performed (ACWP) - The cost actually incurred in accomplishing the work performed within the given time period.

(4) From these input values, performance values and trends can be calculated:

(a) The difference between planned and actual cost:

$$\text{Cost variance} = \text{BCWP} - \text{ACWP}$$

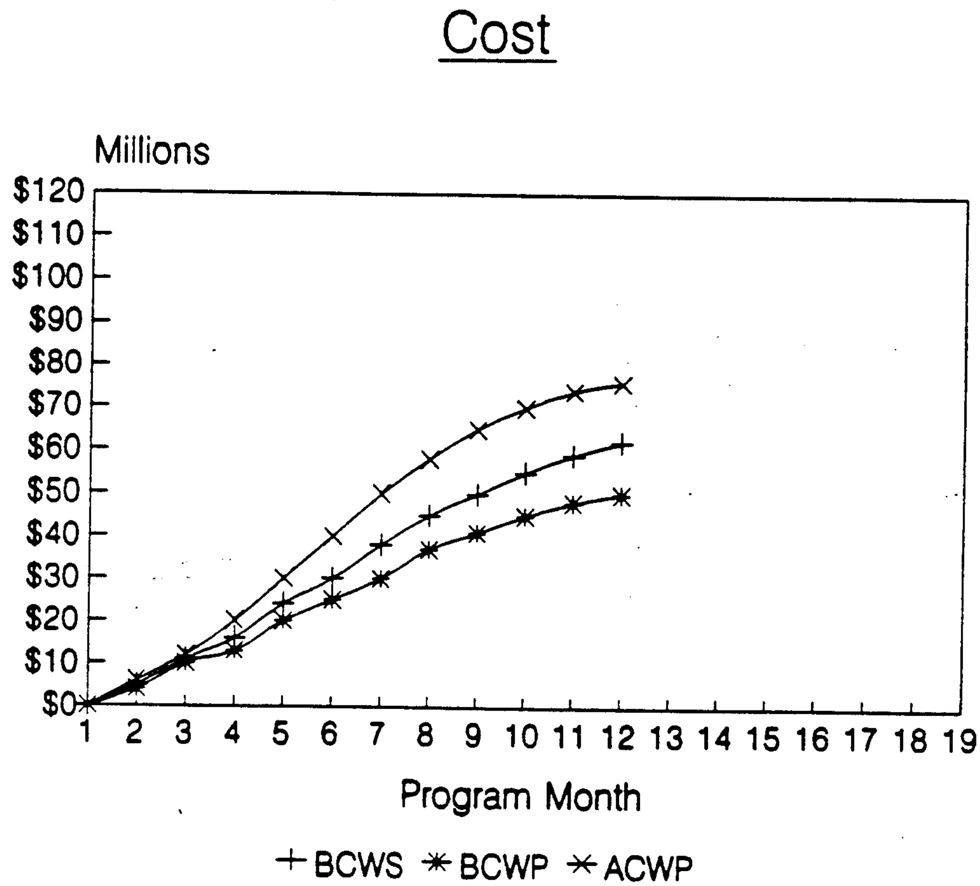

Figure 17-2. Sample Cost Metric

(b) The difference between the amount of work planned to be completed and actually completed:

Schedule variance = BCWP - BCWS

(5) The cost and schedule variances for the project of Figure 17-2 are portrayed in Figure 17-3. It is over cost and behind schedule. Note: Variances of zero would mean that the planned budget and schedule were being met.

d. Data requirements. Note: Use cumulative to date values, not current reporting period values for all cost data supplied.

(1) For each CSCI, for each activity type: (Collect data on the following activities at the CSCI level: requirements analysis, design, code and unit testing, CSC(s) integration and test, FQT, software problem/change resolution.)

(a) CSCI identifier

(b) Activity type name

(c) BCWS

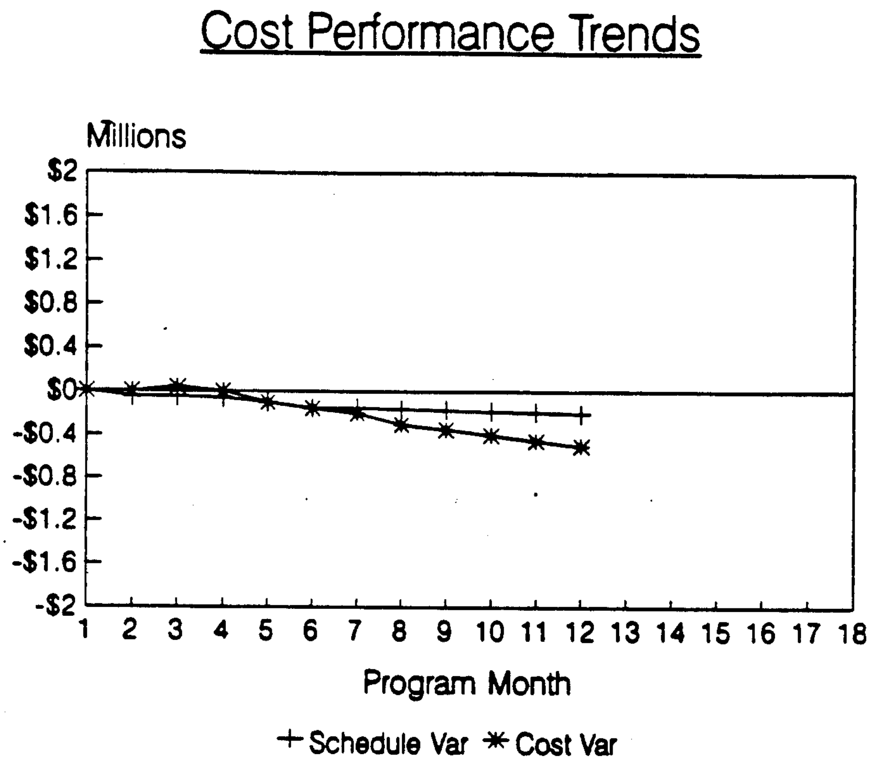

Figure 17-3. Sample Cost Performance Trends

(d) BCWP
(e) ACWP

(2) For the project/system:

(a) For each activity type: (Collect data on the following activities at the system level: CSCI integration and testing, software engineering management, software quality assurance, software configuration management, verification and validation, tools, new equipment and facilities, software data.)

- Activity type name
- BCWS
- BCWP
- ACWP

(b) Project totals of:

- BCWS
- BCWP
- ACWP

e. Frequency of reporting. Monthly.

f. Use/interpretation.

(1) Software development costs include costs from all of the activities described in the algorithm/ graphical display section above.

(2) Software engineering management includes the planning and control of all software engineering efforts, excluding the actual design and hardware

engineering efforts, to the extent of its direct relationship and impact to the software engineering efforts.

(3) Software quality assurance costs include all costs associated with the quality support team including-attendance at configuration audits, document reviews, and related activities.

(4) Verification and validations costs include all costs related to V&V by either corporate or independent agent.

(5) Tools costs include the software required to support and maintain the system while not directly employed in the operation of the system in its intended mission such as compilers, CASE tools, and test data libraries.

(6) Equipment and facilities include the entire range of new facilities, equipment, and test program set costs needed to support software development or maintenance including microprocessor development systems, performance analyzers, diagnostic equipment, and modernization of facilities.

(7) Software data costs are those associated with the preparation and review of all software technical data requirements. This activity type does not include the efforts such as design, requirements analysis and coding, required in developing the software.

(8) This metric is used to track software expenditures versus allocations over the life of a program. Status needs to be determined not only on the present percent of allocation used, but also in relation to what has been done to date and how much is yet to be done (fault profiles, breadth of testing, depth of testing, reliability, manpower (optional), and development progress (optional)). Further insight into risk can be determined by examining expenditures relating to re-work (i.e., fixing faults and requirements changes). Exceeding the allocation at any point in time is cause for concern and investigation.

(9) Cost data should also be interpreted in the context of the software events and deliveries scheduled for the program. Undesirable cost trends may signal impending delays of major events or milestones. A sample program schedule is shown as Figure 17-4.

(10) Trends in cost and schedule variances should be tracked over time. Consistently or increasingly negative values for the variances are signals that the project may be delivered behind schedule (negative schedule variance) or exceed budget (negative cost variance) at its originally scheduled time of completion.

g. Rules of thumb. No formal threshold values are given. Management attention needs to be heightened whenever expenditures are nearing allocated values and

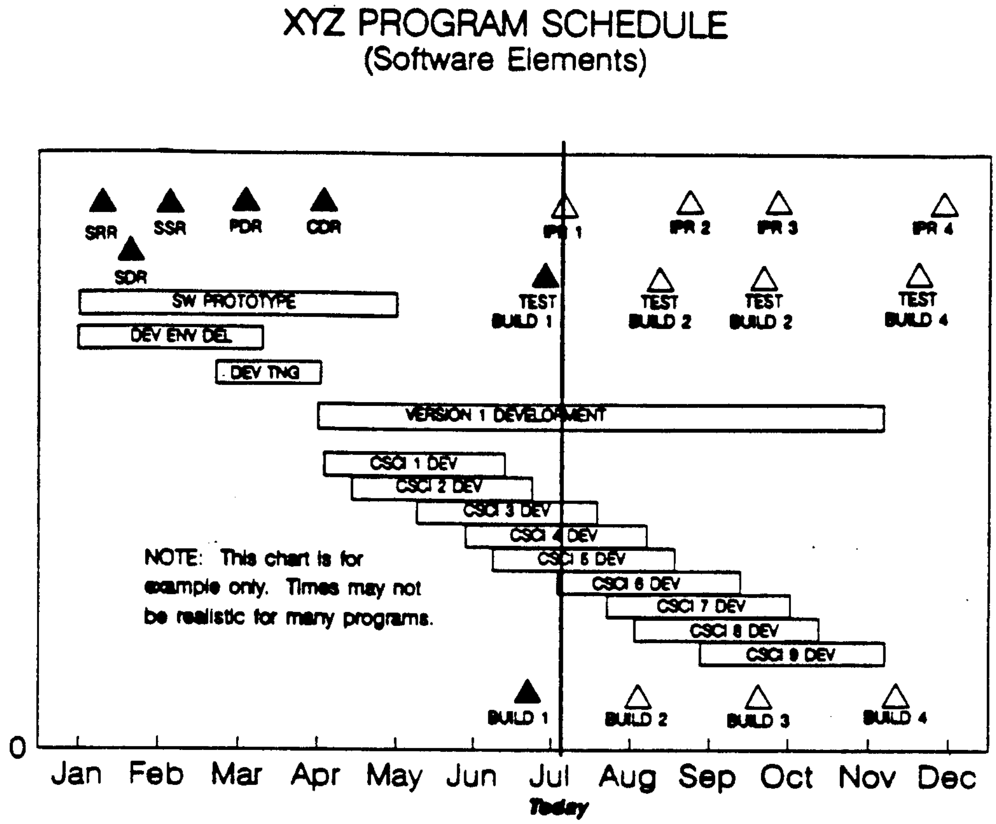

Figure 17-4. Sample Program Schedule

much work is yet to be done. A program review may be necessary in this case and should be mandatory when an allocation is actually exceeded.

h. References. References (a) and (j) of Section III are applicable to this metric.

17-6. Schedule metric

a. Purpose/description. The schedule metric indicates changes and adherence to the planned schedules for major milestones, activities and key software deliverables.

b. Life cycle application. Begin collecting data at program start, and continue for the entire software development.

c. Algorithm/graphical display.

(1) Plot planned and actual schedules for major milestones and key software deliverables as they change over time.

(2) On the sample graph shown in Figure 17-5, the PDR and CDR milestone schedules are plotted over time.
Any milestone or event of interest can be plotted. Similar plots can also be made for key product

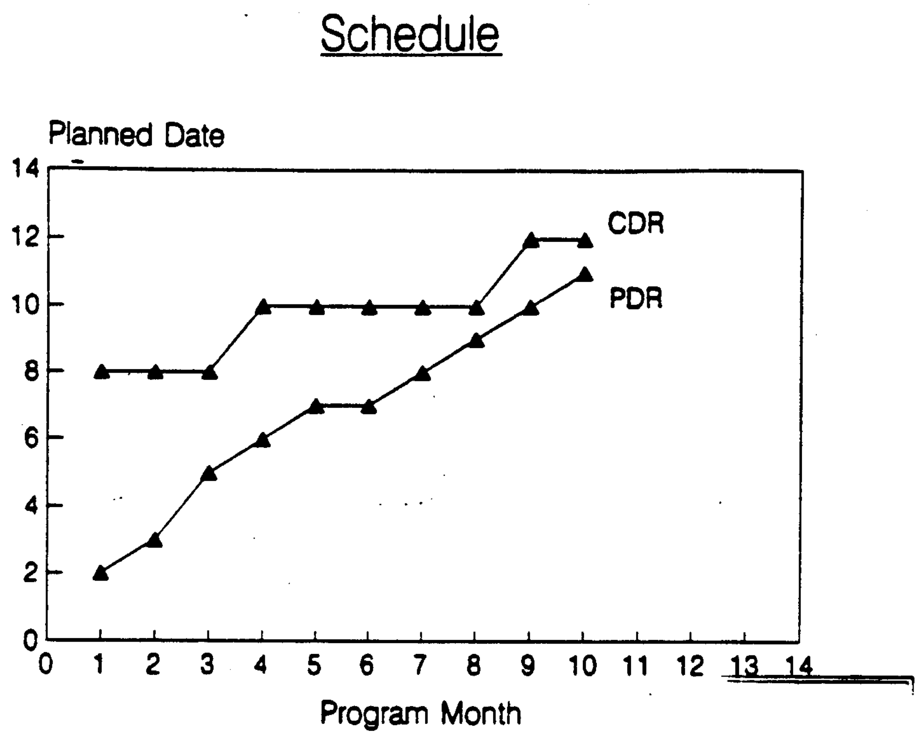

Figure 17-5. Sample Schedule Metric

deliverables (e.g., Software Product Specification (SPS)). To read the graph, find the actual date (program month) on the x-axis, and read the appropriate planned date on the y-axis. For example, at month one, the PDR was planned for month two, and the CDR was planned for month eight. At month two, the PDR schedule has slipped to month three (a slip of one month), whereas the CDR schedule has remained the same. At month three, the PDR schedule has slipped to month five (an additional slip of two months), whereas the CDR schedule has remained the same.

(3) Longer duration events can be plotted as shown in Figure 17-6 to reflect changes in event duration as well as changes in expected starting dates. An example would be tracking the various software development phases.

(4) A table showing the schedule and status of starting and ending dates for key activities and events can be produced as illustrated in Table 17-2. A negative entry in a "slip" column indicates that the date has been moved earlier in time.

d. Data requirements.

(1) Major milestone schedules. Examples of milestones are SDR, SRR, SSR, PDR, CDR, FQT, FCA, PCA, ASARC, and MAISRC.

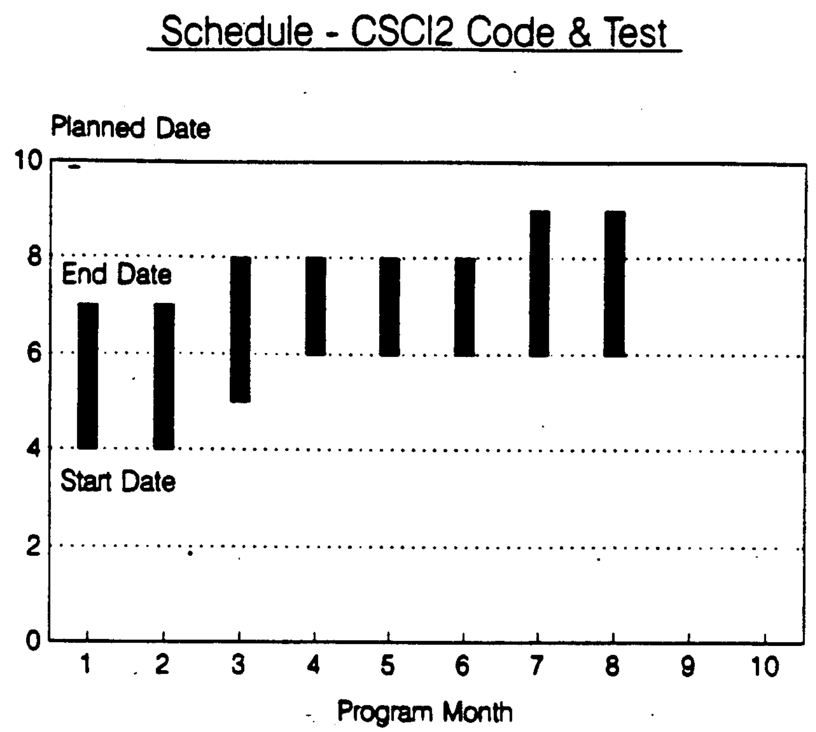

Figure 17-6. Sample Schedule Metric

Table 17-2. Sample Software Event Schedule Status

Event Name	Latest Slip in Start Date (months)	Cumulative Slip in Start Date (months)	Latest Slip in End Date (months)	Cumulative Slip in End Date (months)
PDR	4	5	4	5
CDR	3	4	3	4
CSCI1 Code & Test	0	0	0	0
CSCI2 Code & Test	5	7	3	4
Integration Testing	3	4	2	2
FQT	2	3	2	3
DT	0	0	-1	-1
OT	0	0	0	0

(2) Delivery schedule for key software deliverables. Examples of software deliverables are SDP, SPS, SSS, IRS, VDD, SRS, SDD, STP, STD, and STR.

(3) Software/system program schedules. Examples of other software or system activities and events of interest are CSCI development (or its subcomponents, requirements analysis, design, code and unit test, etc.), CSCI integration test, DT and OT.

(4) For the reporting period: For each milestone, deliverable, event or activity to be tracked:

(a) Event name
(b) Date of report
(b) Date the event is planned to start
(c) Date the event is planned to end
(d) Date the event actually started
(e) Date the event actually completed

e. Frequency of reporting. Monthly.

f. Use/interpretation.

(1) The schedule metrics, when plotted as they change over time, provide indications of problems in meeting key events or deliveries. The higher the slope of the trend line for each event, the more problems are being encountered. Milestone slippages should be investigated. Potential clustering (i.e., bunching-up in time) of key events should be guarded against.

(2) The schedule metric can be used in conjunction with several other metrics to help judge program risk. For example, it could be used with the test coverage metrics to determine if there is enough time remaining on the current schedule to allow for the completion of all testing.

(3) The schedule metric passes no judgement on the achievability of the contractor's development plan.

g. Rules of thumb. No formal evaluation criteria for the trend of the schedule metrics are given. However, large slippages are indicative of problems. Maintaining conformance with calendar-driven schedules should not be used as the basis for proceeding beyond milestones.

h. References. None.

17-7. Computer resource utilization metric

a. Purpose/description. This metric is intended to show the degree to which estimates and measurements of the target computer resources (central processing unit (CPU) capacity, memory/storage capacity, and input/output (I/O) capacity are changing or approaching the limits of resource availability and specified constraints. Over-utilization of computer resources can have serious impacts on cost, schedule, and supportability. Approaching resource capacity may necessitate hardware change or software redesign. Exceeding specified reserve requirements can have

similar impacts in the post-deployment phase. Proper use of this metric can also assure that each processor in the system has adequate reserve to allow for future growth due to changing or additional requirements without requiring re-design. This metric can be applied to a system architecture which is distributed or centralized.

b. Life cycle application. Early in the design phase, CPU utilization budgets should be established for each processor in the system. I/O utilization and throughput budgets should be allocated to each I/O channel in the system. Memory/storage usage budgets should be allocated to all CSUs, CSCs, CSCIs and temporary and permanent data files early in the design phase. Based on these estimates CPU, memory, and I/O allocations must be documented in the Software Requirements Specification prior to the Software Specification Review, and must be documented in the Software Design Document prior to the Critical Design Review. All changes to these initial estimates should be reported, including those caused by hardware modifications. For the memory and I/O categories, actual usage should be measured monthly during coding, unit testing, integration testing, CSCI testing and system-level testing. For the CPU usage statistic, measurements should be taken monthly after the beginning of unit testing. Actual utilization should be formally demonstrated at the system level for each resource under peak loading conditions during FQT, and during PDSS if additional capability is added.

c. Algorithm/graphical display.

(1) The allocation for each resource type should not exceed the target upper bound utilization for any category (for some systems, the allocation equals the target upper bound).

(2) CPU and I/O resource utilization are typically measured by the system. While the measurements contribute slightly to system overhead, the feature typically comes with the system it its off the shelf configuration. In instances where the system does not measure itself in terms of CPU and I/O utilization, the percent utilization must be computed.

(3) For memory/storage resources, the percent utilization must be computed. For memory, the resource is random access memory (RAM). RAM for this metric refers to both volatile and non-volatile (including read only) memories. For storage, the resources include disk space and other mass storage.

(4) As software development proceeds, the measured values for each category should be projected out to the "full" system. For example, if half of the "size" of the software is built and measured, the projected value for utilization would be the actual for the portion built and measured to date, plus the

budgeted portion yet to be added.

(5) In the sample graph of Figure 17-7, target upper bound utilization is shown as a straight line. In reality, the target upper bound utilization can change over time. The sample shown represents the utilization of a single CPU resource; similar graphs should be constructed for the utilization of all other CPUs plus each I/O and memory resource.

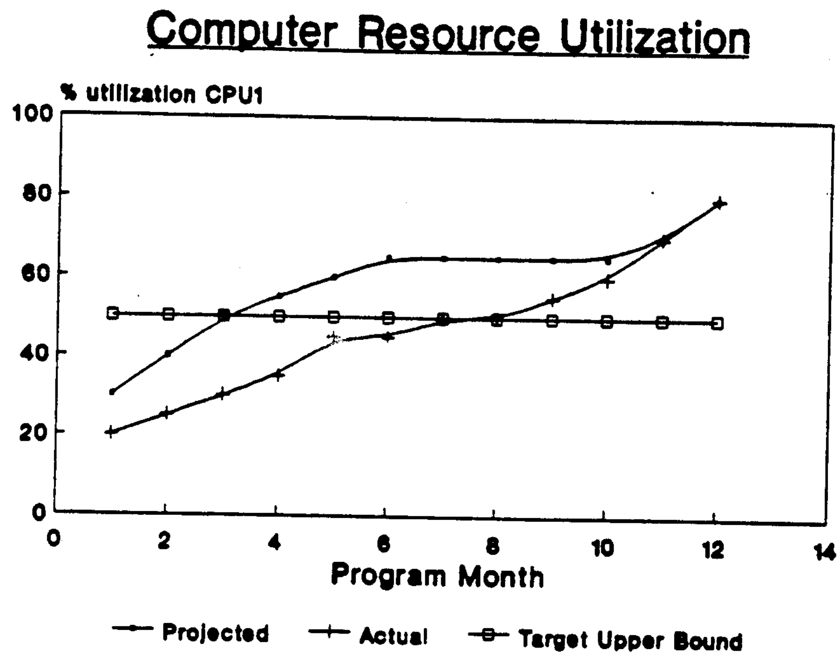

Figure 17-7. Sample Computer Resource Utilization

d. Data requirements. Actual usage should be measured during peak operational loading periods and should include the operating system and non-developer supplied software as well as the development software. Similarly, projected usage should be based on estimates using peak operational loading periods and should include the operating system, development software and non-developer supplied software. Where "target" is used in these data elements, it is actually meant to construe the target upper bound. The data requirements include:

(1) For each CPU in the system:

(a) CPU identifier
(b) Target CPU usage (% of capacity)
(c) Actual CPU usage (% of capacity)
(d) Projected CPU usage (% of capacity)

(2) For each I/O channel in the system:
(a) I/O channel identifier
(b) Target I/O usage (% of capacity)
(c) Actual I/O usage (% of capacity)
(d) Projected I/O usage (% of capacity)
(3) For each RAM in the system (in bytes):
(a) RAM identifier
(b) Capacity
(c) Target upper bound
(d) Projected usage
(e) Actual usage
(4) For each mass storage device in the system (in bytes):
(a) Storage device identifier
(b) Capacity
(c) Target upper bound
(d) Projected usage
(e) Actual usage
(5) For each CSCI in the system:
(a) CSCI identifier
(b) RAM allocation budget as specified in the requirements (in bytes)
(c) Actual RAM usage (in bytes)
(d) Mass storage allocation budget (in bytes)
(e) Actual mass storage usage (in bytes)

e. Frequency of reporting.

(1) CPU, I/O, memory/storage allocation -- monthly starting with SSR.

(2) CPU, I/O, memory/storage usage (actual, projected, and target upper bound) -- monthly starting with CDR.

f. Use/interpretation.

(1) Resource utilization tends to increase over the development of a project. Therefore, adequate planning must be done to ensure that the software's operation does not put undue demands on the target hardware's capabilities. This measure tracks utilization over time to make sure that target upper bound utilization is not exceeded and that sufficient excess capacity remains for future growth and for periods of high stress loading.

(2) In multi-processor environments, each processor should be tracked separately, and each should be allocated a planned utilization.

(3) In instances where the development and target environments differ in types and/or capacities, caution must be taken in computing and analyzing the measures. Translations are acceptable up to a certain point, but testing on the target hardware must take place as early as possible.

(4) Tailoring may be appropriate for situations when dynamic allocation, virtual memory, parallel processing, multitasking, or multiuser-based features are employed.

(5) Initial estimates should be retained for comparison with what is finally achieved in order to aid in scoping future programs.

(6) In addition to collecting utilization data throughout the build-up of contractor testing (including single thread to multiple thread), measurements should also be taken during system level stress testing.

(7) During development, it is important to look at both actual and projected values in relation to the target upper bound values. If either exceeds the target values, extra attention should be paid to assure that the projections fall below the target upper bound value by project completion. If it is apparent from the projections that the target upper bound limits will be exceeded, action must be taken to either optimize the software or upgrade the capability of the target configuration.

(8) Sudden drops in utilization may reflect either new systems capacity or new software that embodies more efficient programming.

(9) Computer resource utilization metrics should be used in conjunction with the test coverage/success metrics (breadth and depth of testing) to ensure that measures of the actual usage are representative and portray the entire system under realistic stress loads. If the development progress metric is available, computer resource utilization metrics should be used in conjunction with development progress to ensure remaining development can be accomplished without exceeding planned utilization.

(10) Computer resource utilization provides the link to total system performance. As mentioned previously, on many computer platforms, the data are relatively easy to collect (indeed, often self-measured), and are often built in to the overhead of the system. On other platforms this may not be the case. Collecting computer resource utilization data will contribute some small amount to system overhead.

g. Rules of thumb.

(1) Rules of thumb depend on the technology employed for each system. When using processors designed to operate at 100% of capacity, design for 90%, to allow for the increase in planned utilization which almost inevitably occurs during design and development. Actual utilization can approach or, depending on the processor, equal 100% with no deterioration in performance.

(2) For processors which are not designed to run efficiently at 100% of capacity, one must be careful not to approach 100% utilization. For embedded/tactical systems, design for no more than 50% utilization for memory/storage, CPU, and I/O resources. For information area systems, a higher target upper

bound value may be allowable, but should be specified in the requirements documents. Performance may deteriorate when utilization exceeds 70% for time-critical applications. Schedule and cost can be severely impacted as utilization exceeds 90%.

(3) For systems employing virtual memory architectures, usage of RAM is not as important as measuring the amount of swapping that occurs during peak load periods.

(4) If, at any time during development, actual or projected computer resource utilization exceeds target upper bound utilization, an immediate review must be held. Corrective action (e.g., software re-design, hardware upgrades, etc.) must be taken before proceeding to the next stage of development.

h. References. References (a) and (g) of Section III are applicable to this metric.

17-8. Software engineering environment metric

a. Purpose/description. The software engineering environment metric provides a rating of the contractor's applied software engineering principles. Examples of these principles are the use of structured design techniques, the extent of tool usage, and the use of program design language (PDL). If practical, aspects of the methodology could also be applied to materiel developer personnel or the program manager's matrix support staff for the purpose of assessing capabilities with respect to software development. Rating of software developers should be performed by a qualified independent group. Performing a software engineering environment assessment is described in report CMU/SEI-87-TR-23. The PM is responsible for ensuring that the proper methodology is used during the assessment of software process maturity.

b. Life cycle application. At each point a software contractor is brought on to a program. Reassess any previously identified risks at major milestones to monitor improvements in the contractor's software engineering process maturity.

c. Algorithm/graphical display. Follow the methodology outlined in CMU/SEI-87-TR-23, which includes the following:

(1) Collect questionnaire data from contractor.

(2) Conduct follow-up visit (by the assessment team) to answer further questions, observe tools, etc.

(3) Perform assessment.

(4) Calculate the process maturity level. The levels are broadly defined as possessing the following characteristics:

(a) Initial (level one)

- ill-defined procedures and controls
- no consistent application of software engineering management to the process

- no use of modern tools and techniques

(b) Repeatable (level two)
- management of costs and schedules
- use of standard methods and practices for managing some software development activities

(c) Defined (level three)
- software development process is well-defined in terms of software engineering standards and methods
- increased organizational focus on software engineering
- use of design and code reviews
- internal training programs
- establishment of software engineering process group

(d) Managed (level four)
- software development process is quantified, measured, and well-controlled
- decisions are based on quantitative process data
- use of tools to manage design process
- use of tools to support data collection and analysis
- accurate projection of expected errors

(e) Optimized (level five)
- major focus on improving and optimizing process
- sophisticated analysis of error and cost data
- employment of error cause analysis and prevention studies
- iterative improvement of process

d. Data requirements. Responses to questionnaire and rating results.

e. Frequency of reporting. As needed to evaluate software process maturity standing.

f. Use/interpretation.

(1) The software engineering environment rating provides a consistent measure of the capability of a contractor to use modern software engineering techniques in his development process, and therefore his capability to instill such principles and characteristics in the product. The basic assumption to this approach is that a quality process results in a quality product. Other metrics, as well as other evaluation techniques, should be used to examine the quality of the product.

(2) The software engineering environment rating will be used to validate the correlation between software process maturity and the quality of the resulting software product.

(3) The use of the software engineering environment rating may encourage contractors to improve weaknesses in their software development process in order to increase their rating. A higher rating will increase the contractor's chance of being selected for future software development projects.

g. Rules of thumb. None. The metric will assist in validation of the Army metric program only. However, the Software Engineering Institute reports that currently, only a very small percentage (i.e., 2-3%) of companies have achieved ratings of level 3, 4, or 5. Most companies are rated at level 1 or 2. A value of 1 is the lowest maturity level and 5 represents the highest level.

h. References. Reference (e) of Section III is applicable to this metric.

17-9. Requirements traceability metric

a. Purpose/description. The requirements traceability metric measures the adherence of the software products (including design and code) to their requirements at various levels. It also aids the combat developer, materiel developer, and evaluators in determining the operational impact of software problems.

b. Life cycle application. Begin tracing during user requirements definition phase. Update the trace in support of major milestones, such as PDR and CDR, or at major software release points.

c. Algorithm/graphical display.

(1) This metric is a series of percentages, which can be calculated from the matrix described below. Note: The term software requirements as used in this metric includes any software interface requirements.

(2) Trace all ORD requirements to the UFD. Identify any ORD requirements not found in the UFD. Calculate the percentage of ORD requirements in the UFD.

(3) Trace all lowest level UFD requirements to the system level specification, and trace all software-related UFD requirements to the software specifications. Identify any omissions. Calculate the percentage of software UFD requirements that are in the software specification.

(4) The software requirements as specified in the software specifications must then be traced into the software design, code, and test cases.

(5) The technique to perform this analysis is the development of a software requirements traceability matrix (SRTM). The SRTM is the product of a structured, top-down hierarchical analysis that traces the software requirements through the design to the code and test documentation. The SRTM should contain

enough information so that the relationship between various levels of requirements and the requirements to their design and test cases can be observed. A conceptual example of a SRTM is shown in Table 17-3. The software specifications and requirements should be listed in groups which represent higher-order system requirements. In this manner, the grouping of CSUs which represent a required system function can be readily seen. Also, it is good practice to trace the requirements at additional levels between design and code. For example, they can be traced to functional decomposition documents, flow diagrams, data dictionaries, etc. (Note: In Table 17-3, question marks indicate that tracing has not yet occurred. At each level of the trace, a single requirement can be traced to multiple lower level requirements.)

Table 17-3. Sample Software Requirements Traceability Matrix

ORD Reqt	UFD Reqt	SSS Reqt	SRS/IRS Reqt	Design			Code	Test Case
				CSCI	CSC	CSU		
r1	r1	r1	SRS1/r1	CSCI1	CSC1	CSU1	CSU1	TC1
r1	r1	r1	SRS1/r1	CSCI1	CSC1	CSU4	CSU4	?
r1	r2	r1	SRS1/r2	CSCI1	CSC2	CSU3	CSU3	TC2
r1	r3	r2	SRS2/r1	CSCI2	?	?	?	?
r1	r3	r2	IRS1/r1	CSCI2	?	?	?	?
r2	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.

(6) The degree of completion of the SRTM depends upon the current stage of the software life cycle as to which documents are available. The SRTM should be part of the technical data package. From the SRTM, various statistics can be calculated indicating percentage of tracing to various levels. Examples of such calculations are:

- % ORD requirements in UFD
- % software UFD requirements in SRS/IRS
- % software requirements in CSU design
- % software requirements in CSC design
- % software requirements in CSCI design
- % software requirements in code
- % software requirements having test cases identified

(7) It can also be worthwhile to perform a backwards trace (e.g., from code to requirements). In lieu of creating another matrix, one can simply make a list of the distinct entries and compare with a total count of the entries for the column of interest. To carry the-example of doing a backwards trace from code to requirements further, one would make a list of all the distinct CSUs which appear in the "code" column of the SRTM. This list should then be compared with the total list of CSUs for the system. Any CSU which does not appear in the "code" column may not support any requirement. These CSUs should be investigated.

(8) Backwards tracing of requirements at the early stages, such as SRS to UFD, can identify requirements that have been added in the requirements decomposition process. Each requirement in a specification should be attributable in some way to a higher level requirement from a predecessor requirement.

d. Data requirements.

(1) Documented requirements/specifications (ORD, UFD, SSS, SRS, IRS).

(2) Documented design of CSCIs, CSCs, CSUs (SDD, IDD, SPS).

(3) Software test description in accordance with DOD-STD-2167A.

(4) Completed SRTM.

(5) Number of ORD requirements:
- total
- traceable to UFD
- not traceable to UFD

(6) Number of UFD requirements:
- total
- traceable to SSS
- not traceable to SSS
- traceable to ORD
- not traceable to ORD

(7) Number of UFD software requirements:
- total
- traceable to SRS/IRS
- not traceable to SRS/IRS

(8) Number of SSS software requirements:
- total
- traceable to SRS/IRS
- not traceable to SRS/IRS

(9) For each CSCI, Number of SRS/IRS requirements:
- total
- traceable to CSCI design
- traceable to CSC design
- traceable to CSU design
- traceable to code
- covered by one or more test case
- not traceable to UFD

e. Frequency of reporting. Update periodically in support of milestones or major releases.

f. Use/interpretation.

(1) As can be seen above, the tracing of requirements must occur at several levels. This tracing should be a key Government tool at all system requirement and design reviews. It can serve to indicate those areas of requirements or software design that have not been sufficiently thought out. The trend of the SRTM should be monitored over time for closure.

(2) By the nature of the software development process, especially in conjunction with an evolutionary development strategy, the trace of requirements is an iterative process. That is, as new software releases add more functionality to the system, the requirements trace will have to be revisited and augmented.

(3) Although not portrayed graphically above, trends of requirements traceability can be show[illegible] time. For example, during the requirements pha[illegible] the percent of UFD requirements traced into the SRS can be depicted.

(4) The SRTM is heavily tied to the UFD, a concept recently embraced by the user representative community. The regulatory guidance requiring a UFD has not yet been staffed throughout the Army. However, even if a UFD is not used, the SRTM can still be created and used.

(5) One of the important new characteristics that will be embodied in the UFD is grouping requirements by user priority levels. Such a prioritization could be used with the SRTM to highlight certain key user functions.

(6) Another benefit of requirements traceability is that those modules which appear most often in the matrix (thus representing the ones that are most crucial in the respect that they are required for multiple functions or requirements) can be highlighted for earlier development and increased test scrutiny.

(7) The requirements traceability metrics should be used in conjunction with the test coverage metrics (depth and breadth of testing) and the development progress metric (optional) to verify if sufficient functionality has been demonstrated to warrant proceeding to the next stage of development or testing. They should also be used in conjunction with the design stability and requirements stability metrics.

(8) Due to the detailed nature of requirements traceability metrics, they should be a normal product of the V&V effort. The SRTM may be developed by the contractor, but must be verified by an independent agent such as the IV&V contractor.

(9) During PDSS, if a function is modified, the SRTM can be used to focus regression testing on a particular CSCI/CSC/CSU.

g. Rules of thumb.

(1) Do not approve the UFD until all appropriate ORD requirements have been traced into it.

(2) Do not proceed beyond SSR until all software-related UFD requirements have been traced into the software requirements.

(3) Do not proceed beyond CDR until a high trace percentage exists from the ORD, through the UFD, through the system specification, through the software specification, to the design at CSCI, CSC, and CSU level has been achieved.

(4) Do not proceed to formal Government testing until a 100% trace to the code has been achieved.

(5) Do not start formal Government testing unless 100% of the SRS requirements are traceable to test cases. This reflects good software engineering practice and will insure that the software developer is ready to start formal Government testing.

h. References. Reference (f) of Section III is applicable to this metric.

17-10. Requirements stability metric

a. Purpose/description. The metrics on requirements stability indicate the degree to which changes in the software requirements or changes in the contractor's understanding of the requirements affect the development effort. It also allows for determining the cause of requirements changes.

b. Life cycle application. Begin collecting during user requirements definition phase. Measure requirements with respect to the UFD between MSCR Milestone I and II (user responsibility). Measure requirements with respect to the SRS after MSCR Milestone II (materiel developer responsibility).

c. Algorithm/graphical display.

(1) Samples of the requirements stability metric are shown in Figures 17-8 and 17-9.

(2) The first chart shows cumulative requirements discrepancies over time, versus closure of those discrepancies. The second chart is a representation of the effect of requirements changes on the code (percent of source lines of code (SLOC) changed by month). In actuality, one should develop several versions of the second chart. One version should show the number of Engineering Change Proposals - Software (ECPs-S) due to user changes and the number of ECPs-S due to developer changes. The second version should show the percent SLOC affected by developer changes. Additionally, one might look at the number of modules affected by both types of requirements changes.

d. Data requirements. The difficulties in agreeing on a standard definition of a line of code are well recognized. A "line of code" will differ from language

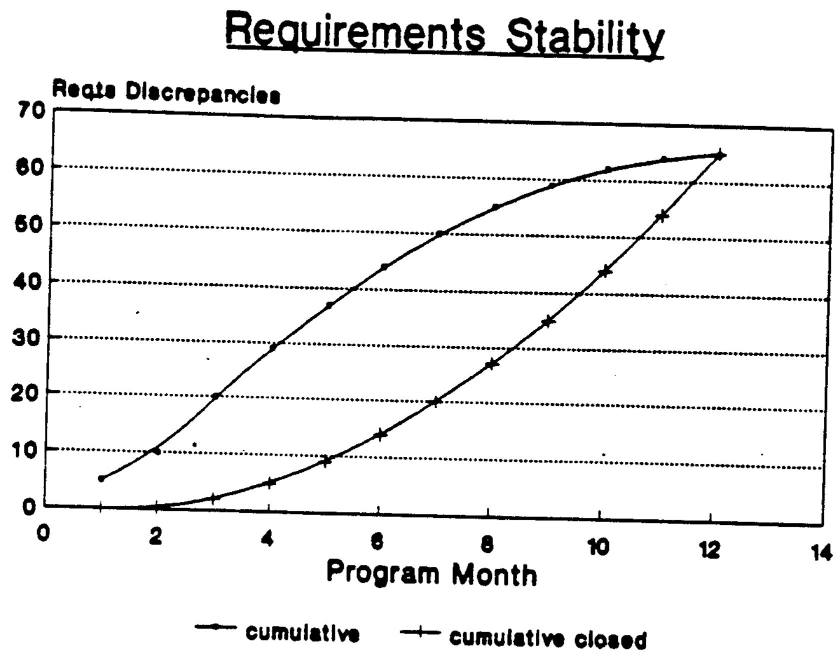

Figure 17-8. Sample Requirements Stability Metric

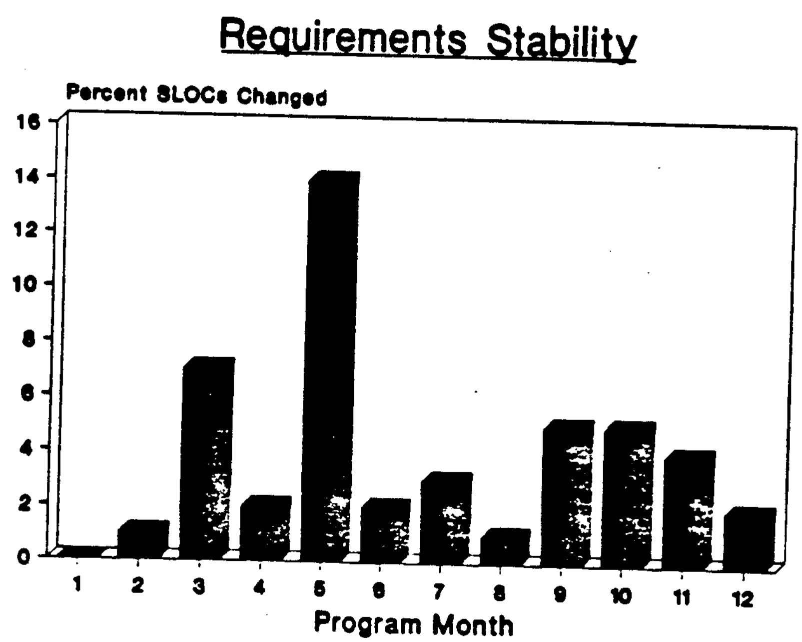

Figure 17-9. Sample Requirements Stability Metric

to language, as well as from programming style to programming style. In order to consistently measure source lines of code count all non-comment, non-blank, executable and data statements. The data requirements are: For each CSCI:

(1)- Number of software requirements discrepancies as a result of each review (SSR, PDR, CDR).

(2) Monthly status (cumulative total/total number resolved) of above discrepancies.

(3) Number of ECPs-S generated from requirements changes due to user.

(4) Number of SLOC affected by approved ECPs-S due to user changes.

(5) Number of ECPs-S generated from requirements changes due to developer.

(6) Number of SLOC affected by approved ECPs-S due to developer changes.

(7) Number of modules affected by requirements changes due to user.

(8) Number of modules affected by requirements changes due to developer.

(9) Total number of SLOCs.

(10) Total number of SRS requirements.

(11) Number of SRS requirements added due to approved ECPs-S.

(12) Number of SRS requirements modified due to approved ECPs-S.

(13) Number of SRS requirements deleted due to approved ECPs-S.

e. Frequency of reporting. Monthly.

f. Use/interpretation.

(1) When a program begins, the details of its operation and design are rarely complete, so it is normal to experience changes in the specifications as the requirements become better defined over time. (Note: Rapid prototyping can help alleviate this problem, or at least cause refinement to happen earlier in development). When design reviews reveal inconsistencies, a discrepancy report is generated. Closure is accomplished by modifying the design or the requirements. When a change is required that increases the scope of the project, an ECP-S is submitted.

(2) The plot of open discrepancies can be expected to spike upward at each review and to diminish thereafter as the discrepancies are closed. For each engineering change, the amount of software affected should be reported in order to track the degree to which ECPs-S increase the difficulty of the development effort. Only those ECPs-S approved by the configuration control board should be counted. Good requirements stability is indicated by a leveling off of the cumulative discrepancies curve with most discrepancies having reached closure.

(3) Causes of program turbulence can be investigated by looking at requirements stability and design stability together. If design stability is low and requirements stability is high, the designer/coder interface is suspect. If design stability is high and requirements stability is low, the interface between the user and the design activity is suspect. If both design stability and requirements stability are low, both the interfaces between the design activity and the code activity and between the user and the design activity are suspect.

(4) The metrics for requirements stability should be used in conjunction with those for requirements traceability, fault profiles, and the optional development progress.

(5) Allowances should be made for higher instability in the case where rapid prototyping is utilized. At some point in the development effort, the requirements should be firm so that only design and implementation issues will cause further changes to the specification.

(6) As mentioned previously, it is recognized that SLOC is somewhat dependent on both the application language as well as the style of the programmer. The key is to watch for significant changes to the measure.

g. Rules of thumb. No formal rules are given here, but a high level of instability at the CDR stage indicates serious problems that must be addressed prior to proceeding to coding. For MSCR systems, requirements stability should be high by MS II.

h. References. Reference (g) of Section III is applicable to this metric.

17-11. Design stability metric

a. Purpose/description. Design stability is used to indicate the amount of changes made to the design of the software. The design progress ratio show how the completeness of the design is advancing over time and helps give an indication of how to view the stability in relation to the total projected design.

b. Life cycle application. Begin tracking no later than PDR and continue for each version until completion.

c. Algorithm/graphical display.

M = Number of modules in current delivery/design.

F_c = Number of modules in current delivery/design that include design related changes from previous delivery.

F_a = Number of modules in current delivery/design that are additions to previous delivery.

F_d = Number of modules in previous delivery/design that have been deleted.

T = Total modules projected for project.

S (stability) = $[M - (F_a + F_c + F_d)] / M$
DP (design progress ratio) = M/T

(1) Although not indicated in Figure 17-10, it is possible for stability to be a negative value. This may indicate that everything previously delivered has been changed and more modules have been added or deleted.

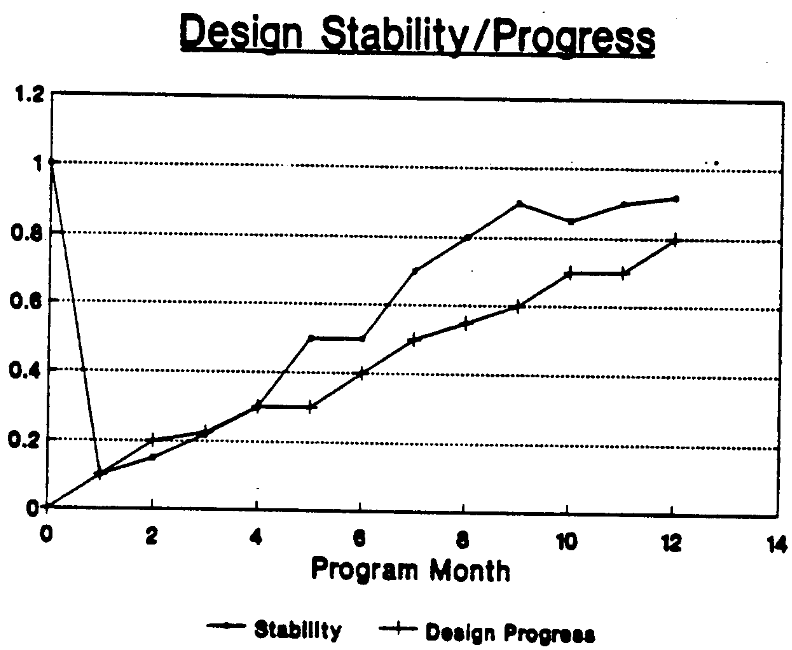

Figure 17-10. Sample Design Stability/Progress Metric

(2) If some modules in the current delivery are to be deleted from the final delivery, it is possible for design progress to be greater than one.

d. Data requirements. For each CSCI and each version:

(1) Date of completion
(2) M
(3) F_c
(4) F_a
(5) F_d
(6) T
(7) S
(8) DP

e. Frequency of reporting. Monthly or at each delivery.

f. Use/interpretation.

(1) Design stability should be monitored to determine the number and potential impact of design changes, additions, and deletions on the software configuration. The trend of design stability provides an indication of whether the software design is approaching a stable state, that is, a leveling off of the curve at a value close to or equal to one. In addition to a high value and level curve the following other characteristics of the software should be exhibited:

(a) The development progress metric is high.

(b) Requirements stability is high.

(c) Depth of testing is high.

(d) The fault profile curve has leveled off and most software trouble reports (STRs) have been closed.

(2) Caution must be exercised, however, due to the fact that this metric does not measure the extent or magnitude of the change within a module.

(3) The higher the stability, the better the chances of a stable software configuration. However, a value close to one is not necessarily good unless M is close to the total number of modules required in the system (DP approaching 1), and the magnitude of the changes being counted are relatively small and diminishing over time. In the case just described, periods of inactivity could be mistaken for stability.

(4) When changes are being made to the software, the impact on previously completed testing must be assessed.

(5) Allowance for exceptional behavior of this metric should be made for the use of rapid prototyping. It is thought that rapid prototyping, while possibly causing lower stability numbers (i.e., higher instability) early in the program, will positively affect the stability metric during later stages of development.

(6) Not all changes made to the software are design related.

(7) The design stability metric can be used in conjunction with the complexity metric to highlight changes to the most complex modules. It can also be used with the requirements metrics to highlight changes to modules which support the most critical user requirements.

(8) Finally, the design stability metric does not assess the quality of the design. Other metrics (e.g., complexity) can contribute to such an evaluation.

g. Rules of thumb.

(1) No hard and fast rules are known at this time. However, allowances should be made for lower stability in the case of rapid prototyping or other

development techniques that do not follow the standard waterfall model for software development. In either case, an upward trend with a high value for both stability and design progress is recommended before acceptance for Government testing. A downward trend should be-cause for concern.

(2) Experiences with similar projects should be used as a basis for comparison. Over time, potential thresholds may be developed for similar types of projects.

h. References. Reference (r) of Section III is applicable to this metric.

17-12. Complexity metric

a. Purpose/definition.

(1) Complexity measures give an indication of the structure of the software and provide a means to measure, quantify and/or evaluate the structure of software modules. They also indicate the degree of unit testing which needs to be performed. It is commonly believed that the more complex the software, the harder it is to test and maintain. Additionally, a highly complex module is more likely to contain embedded errors than a module of lower complexity. Accordingly, lower complexity ratings reflect software that is easier to test and maintain, thus logically resulting in fewer errors and lower life cycle costs.

(2) McCabe's cyclomatic complexity metric measures the internal structure of a piece of software.

(3) Halstead's metrics estimate a program's length and volume based on its vocabulary (operators and operands).

(4) Other simpler complexity metrics are control flow, the number of lines of code per module (relates to the understandability of the module), and the percent comment lines.

b. Life cycle application. Begin collecting McCabe's cyclomatic complexity metric at PDR. Begin collecting other complexity metrics at CDR, as the modules are placed under the developer's configuration control. Revisit during PDSS activities.

c. Algorithm/graphical display. Throughout the discussion of complexity measures, the term "module" is meant to be equivalent to CSU.

(1) McCabe's cyclomatic complexity (C) metric:

$$C = E - N + 2P, \text{ where}$$

E = # of edges (program flows between nodes; i.e. branches)

N = # of nodes (sequential groups of program statements)

P = # of connected components (number of disconnected parts on a flow graph)

(2) An example of a module's flow graph with McCabe's cyclomatic complexity computed is shown in Figure 17-11. Figure 17-12 is a histogram of a CSCI's modules distributed by cyclomatic complexity value.

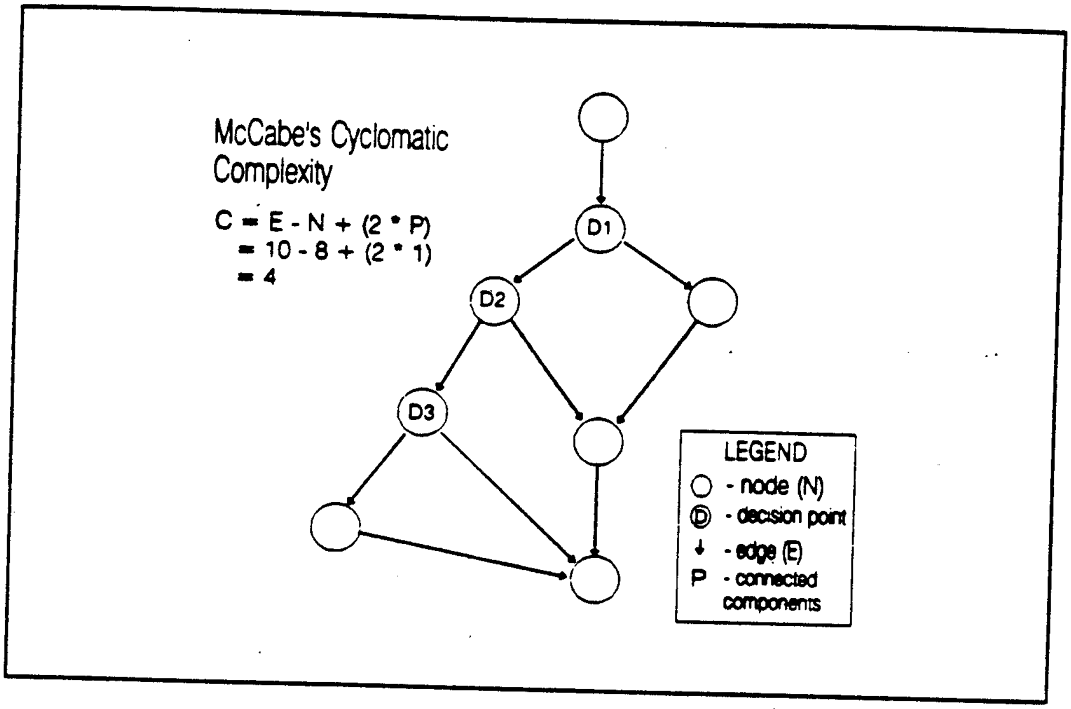

Figure 17-11. Sample Flow Graph

(3) There are additional ways of calculating complexity. One way is to calculate the number of control tokens + 1. Control tokens are programming language statements which in some way provide decision points which modify the top-down flow of the program. In other words, statements such as IF, GOTO, CASE, etc., are considered to be control tokens since they base program flow upon a logical decision thereby creating alternative paths which program execution may follow. A CASE statement would contribute (N - 1) to complexity, where N is the number of conditions or cases associated with the statement.

(4) Halstead's metrics:

Vocabulary: $v = n_1 + n_2$
Program Length: $L = N_1 + N_2$
Volume: $V = L(\log_2 v)$, where

n_1 = # distinct operators
n_2 = # distinct operands
N_1 = total # occurrences of the operators
N_2 = total # occurrences of the operands

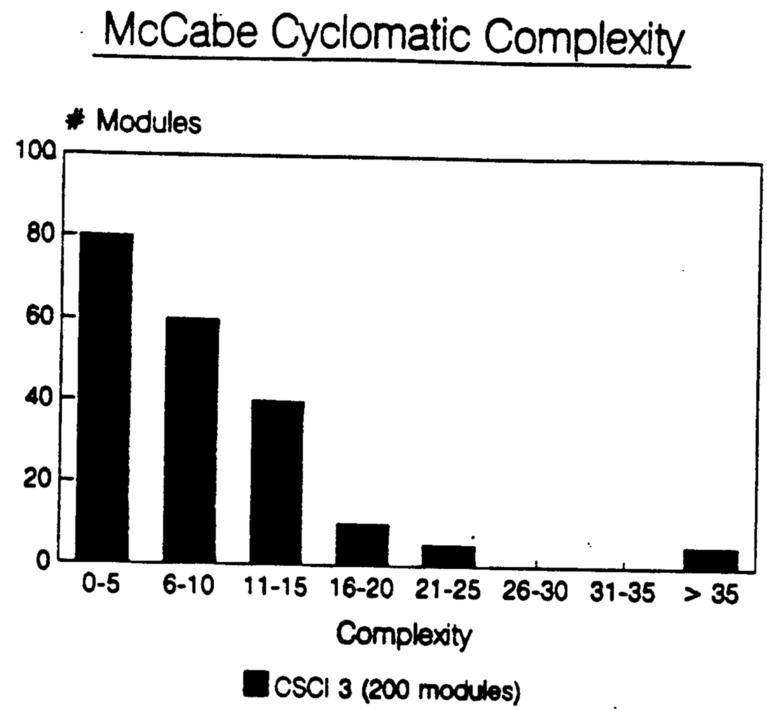

Figure 17-12. Sample Complexity Metric

(5) Control flow metric:

Count the number of times in each module where control paths cross. Control path crossings are also referred to as "knots". For example, a GOTO statement would cause a knot to occur in a module's flow graph.

(6) Non-comment, non-blank, executable, and data statements (herein referred to as lines of code (LOC)) per module metric:

Count the number of non-blank, non-comment, executable, and data statements in each module.

(7) The percent comment lines metric shows the relative amount of explanatory material in a module compared to its size, in lines. For the purposes of computation, blank lines are not considered comment lines.

Percent comment lines metric:

Percent comment lines = (C / T) * 100, where

C = # comment lines in module
T = total # non-blank lines in module

d. Data requirements: For each module:
(1) Source code or PDL
(2) Programming language

(3) Number of nodes
(4) Number of edges
(5) Number of connected components
(6) Number of distinct operators
(7) Number of distinct operands
(8) Total number of occurrences of the operators
(9) Total number of occurrences of the operands
(10) Number of times in each module where control paths cross
(11) Number of LOCs (as defined above) per module
(12) Percent comment lines
(13) All complexity input data and results of calculations listed above

e. Frequency of reporting. Monthly, for any module that has been modified.

f. Use/interpretation.

(1) Automated tools are available and should be used to assist in the computation of the complexity measures.

(2) This metric is used throughout the software life cycle. Requiring a complexity limit as a contractual requirement will stimulate structured programming techniques, thereby impacting design limiting the number of basis paths (i.e. critical paths) in a program at the design and coding stages. It is used during software testing to identify basis paths, to define and prioritize the testing effort, and to assess the completeness of CSU testing. During the maintenance phase, a proposed change should not be allowed to substantially increase the complexity, as this could increase the testing effort and decrease maintainability.

(3) The complexity metrics should be generated for each module in the system. The metrics can be grouped for display in a number of ways (e.g. by CSCI, by individual CSU, etc.). Examination at various levels can provide indications of potential problem areas. These indications can give guidance to the developer on areas where additional concentration is needed, as well as areas where the Government test efforts should focus, such as code walkthroughs, more comprehensive unit level testing, or stress testing. Figure 17-12 portrays a snapshot in time of the complexity values for all the modules in a given CSCI. While the majority of them are within the range of the rules of thumb, it can be seen that several of them have well exceeded them. These modules should be further scrutinized through testing and analysis.

(4) Examination of complexity trends over time can also provide useful insights, especially when combined with other metrics such as design stability or the optional development progress. For example, late software code "patches" may cause the complexity of the patched module to exceed an acceptable limit,

indicating that the design rather than the code should have been changed. It is noted that test resources are better expended on modules that have a relatively high structural complexity rather than on software that will reflect a high number of lines of code tested.

(5) Wherever possible, complexity should be computed for the PDL. The section on rules of thumb describes special interpretation factors for the complexity of PDL.

(6) There are several embedded assumptions and known weaknesses in the complexity metrics. For example, in the computation of McCabe's cyclomatic complexity, there is no differentiation between different kinds of control flows. A CASE statement (which is easier to use and understand than the corresponding series of conditional statements) makes a high contribution to complexity, which is somewhat counterintuitive when one considers that the corresponding series of IF..THEN..ELSE statements would probably be more troublesome from the standpoint of testing, modification, and maintenance. Further, a million straight line instructions are judged to be as complex as a single instruction. Additionally, the interpretation of complexity will be different for different higher order languages.

(7) There are many ways of defining and counting lines of code. The fairly simple definition given in the algorithm above is intended to apply somewhat equally across the spectrum of procedural languages. It should be noted that much research is ongoing into methods and tools for counting lines of code for each language. The definition given here, and used as well in some of the other metrics, is intended to indicate relative amounts of change in modules as they are built and maintained, not just size. This definition may at least allow historical comparisons to be done on similar implementations.

(8) It is also recognized that the percent of comment lines is a very language dependent measure. Additionally, the metric does not address the usefulness or completeness of the comments. Some self-documenting languages require fewer comments than an assembly language or a language like FORTRAN.

(9) It is acknowledged as well that the complexity metrics as outlined in this pamphlet are oriented towards procedural programming languages. When applied to artificial intelligence and pure object oriented languages, care must be taken in interpreting the results.

(10) In cases of high module cyclomatic complexity, various means exist to help identify how it may be reduced. These techniques include calculation of actual complexity and essential complexity. For further details see references cited in part (h).

(11) The use of additional complexity or design structure metrics for languages like Ada (to measure the degree of encapsulation, for example) can lend additional insights into the software structure. Their use is encouraged, but not required via this pamphlet.

(12) It is recommended that this metric be used as soon as practical (e.g., as code is being developed). Also, it must not be relied upon as the sole metric to judge the quality of the design's implementation.

(13) Additional research is underway on ways of assessing the complexity of a design before any code is built. As these design complexity metrics evolve, their use should be pursued, as it is highly desirable to limit the inherent complexity of software while still in the design phase.

(14) To trade off the benefits and limitations of each of the individual complexity measures discussed in this section, the complexity measures should be used as a group. They also should be evaluated in conjunction with the metrics for fault profiles and depth of testing.

g. Rules of thumb.

(1) The following thresholds, which should be applied at the module level, are widely accepted as industry standards. Any value not meeting these thresholds should cause concern about potential problems in the specific metric area.

Metric	Threshold (per module)
Cyclomatic complexity	<= 10
Control flow	= 0
Volume	<= 3200
LOC	<= 200
% Comment lines	>= 60 %

(2) For cyclomatic complexity, the suggested limit is ten for any module. The references below show that the error rate and number of bugs observed for modules having complexities of less than ten is substantially lower than those with complexities greater than ten. A module with complexity greater than ten may need to be restructured (if feasible) into several less complex ones. If the complexity is due to structures like CASE statements, the complexity can be accommodated. However, if the high complexity is due to structures like DO loops and other raw logic, serious attempts should be made to redesign or subdivide the module.

(3) A more recent approach varies the threshold for cyclomatic complexity according to life cycle phase. During the design phase it is suggested that the value not exceed seven for program design language

to allow for expected growth to a value of ten during implementation to code.

h. References. References (d), (l), (n), (p), (q), (r) and (v) of Section III are applicable to this metric.

17-13. Breadth of testing metric

a. Purpose/description. Breadth of testing addresses the degree to which required functionality has been successfully demonstrated as well as the amount of testing that has been performed. This testing can be called "black box" testing, since one is only concerned with obtaining correct outputs as a result of prescribed inputs.

b. Life cycle application. Begin collecting data at the end of unit testing.

c. Algorithm/graphical display.

(1) Breadth of testing consists of three different measures. One measure deals with coverage and two measures deal with success. These three subelements are portrayed in the following equation:

$$\underbrace{\frac{\text{\# reqts tested}}{\text{total \# reqts}}}_{\textbf{Coverage}} * \underbrace{\frac{\text{\# reqts passed}}{\text{\# reqts tested}}}_{\textbf{Test Success}} = \underbrace{\frac{\text{\# reqts passed}}{\text{total \# reqts}}}_{\textbf{Overall Success}}$$

(2) Breadth of testing "coverage" is computed by dividing the number of requirements that have been tested (with all applicable test cases under both representative and maximum stress loads) by the total number of requirements.

(3) Breadth of testing "test success" is computed by dividing the number of requirements that have been successfully demonstrated through testing by the number of requirements that have been tested.

(4) Breadth of testing "overall success" is computed by dividing the number of requirements that have been successfully demonstrated through testing by the total number of requirements.

(5) All three measures of breadth of testing should be tracked for SRS requirements, IRS requirements and UFD requirements, throughout the development process if possible. In actuality, functional testing per CSCI is normally only done as part of FQT and system level testing.

(6) The results of each measure must be reported and can be simultaneously displayed over key test events with the use of stacked vertical bar graphs as shown in Figure 17-13. Coverage and success can also be displayed over time in a manner similar to that shown in Figure 17-14, for the depth of testing metric.

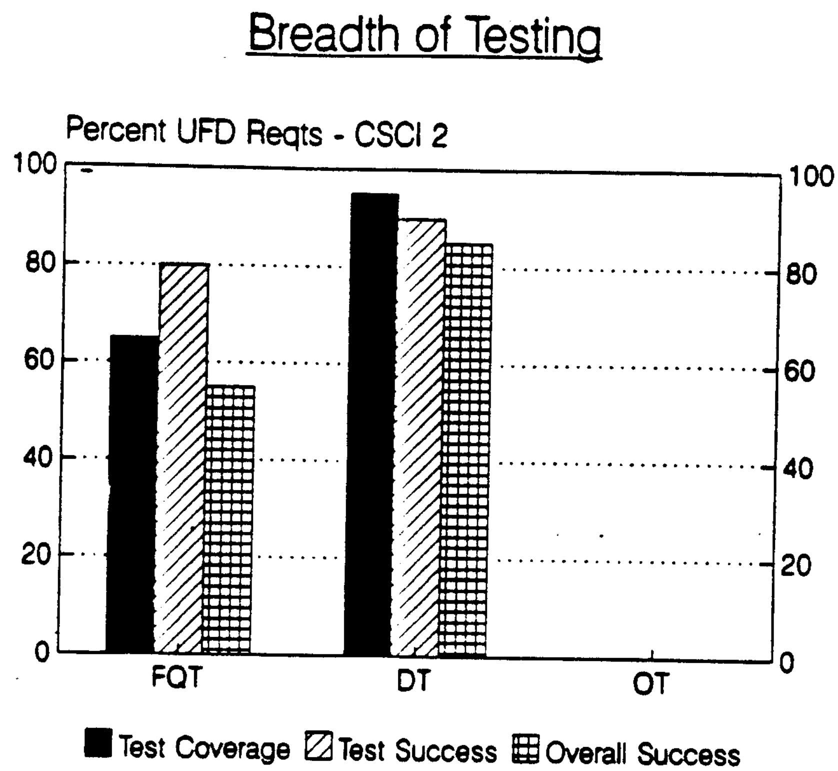

Figure 17-13. Sample Breadth of Testing Metric

(7) It is suggested that coverage or success values be expressed as percents by multiplying each value by 100 before display in order to facilitate understanding and commonality among metrics presentations.

d. Data requirements. For each CSCI:

(1) Number of SRS requirements.

(2) Number of SRS requirements tested with all planned test cases.

(3) Number of SRS requirements successfully demonstrated through testing.

(4) Number of IRS requirements.

(5) Number of IRS requirements tested with all planned test cases.

(6) Number of IRS requirements successfully demonstrated through testing.

(7) For each of the four UFD priority levels:

(a) Number of UFD requirements.

(b) Number of UFD requirements tested with all planned test cases.

(c) Number of UFD requirements successfully demonstrated through testing.

(8) Test identification (e.g., FQT, DT, OT).

e. Frequency of reporting. Monthly throughout software functional and system level testing.

f. Use/interpretation.

(1) The coverage portion of breadth of testing indicates the amount of testing performed without regard to success. By observing the trend of coverage over time, one gets an idea of the extent of full testing that has been performed.

(2) The success portion of breadth of testing provides indications about requirements that have been successfully demonstrated. By observing the trend of the overall success portion of breadth of testing over time, one gets an idea of the growth in successfully demonstrated functionality.

(3) The breadth of testing metrics for coverage and overall success should be used together and in conjunction with the requirements traceability metrics, the (optional) development progress metrics, and fault profiles so that potential problem areas can be identified. The breadth of testing metric must be used in conjunction with the metrics for depth of testing, requirements stability, and design stability.

(4) One of the most innovative aspects of the UFD is the categorization of requirements in terms of user priority levels. With this approach, the most important requirements can be highlighted. Using this prioritization scheme, one can partition the breadth of testing metric to address each priority level. At various points along the development path, the pivotal requirements for that phase can be addressed in terms of tracing, test coverage, and test success.

(5) At each UFD priority level, the test cases to be used for evaluating the success of a requirement should be developed through the Test Integration Working Group (TIWG) process in order that sufficient test cases are generated to adequately demonstrate the requirements.

(6) Failing only one test case results in a requirement not being successfully demonstrated. If sufficient resources exist, an additional, optional way to address breadth of testing consists of examining each requirement in terms of the percent of test cases that have been performed and passed. In this way, partial credit for testing a requirement can be shown (assuming multiple test cases exist for a requirement), as opposed to an all or nothing approach. This method, which is not mandated here due to cost and reporting considerations, may be useful in providing additional granularity into breadth of testing.

(7) It is recognized that there is possible subjectivity in assessing whether requirements have been satisfied.

(8) It should be noted that some requirements may not be testable until very late in the testing process (if at all).

(9) Breadth of testing should be revisited as a result of Government testing. Also, any time there is a change in requirements, breadth of testing must be revisited.

(10) During post deployment software support, this metric should be used with the requirements traceability metrics to indicate areas which need regression testing.

g. Rules of thumb. The Government should clearly specify what functionality should be in place at each phase of development. This process is obviously system dependent. At each stage of testing (unit through system level stress testing), emphasis should be placed on demonstrating that a high percentage of the functionality needed for that stage of testing is achieved. Prior to the formal Government operational test, most functions should be demonstrated under stress loading conditions.

h. References. Reference (o) of Section III is applicable to this metric.

17-14. Depth of testing metric

a. Purpose/description. The depth of testing metric provides indications of the extent and success of testing from the point of view of coverage of possible paths/conditions within the software. Depth of testing consists of three separate measures (plus an optional fourth), each of which is comprised of one coverage and two success sub-elements (similar to breadth of testing). The testing can be called "white box" testing, since there is visibility into the paths/conditions within the software.

b. Life cycle application. Begin collecting data at CDR and continue through development as changes occur in either design, implementation or testing. Revisit as necessary during PDSS.

c. Algorithm/graphical display. A path is defined as a logical traversal of a module, from an entry point to an exit point. If one refers back to the discussion of the complexity metric, a path is actually a combination of edges and nodes. See the complexity metric for the definition of an edge.

(1) The path metric for each module is defined as the number of paths in the module that have been successfully executed at least once, divided by the total number of paths in the module.

(2) The statement metric for each module is the number of executable statements in the module that have been successfully exercised at least once, divided by the total number of executable statements in the module.

(3) The domain metric for each module is the number of input instances that have been successfully tested with at least one legal entry and one illegal

entry in every field of every input parameter, divided by the total number of input instances in the module. (Note: In addition to test coverage, this metric serves to partially address the robustness of the software.)

(4) The optional decision point metric for each module is the number of decision points in the module that have been successfully exercised with all classes of legal conditions as well as one illegal condition (if any exist) at least once, divided by the total number of decision points in the module. Each decision point containing an "or" should be tested at least once for each of the condition's logical predicates.

(5) Figure 17-14 portrays test coverage and overall success for the paths within a CSCI, which is computed as a composite of its module level path metrics. The other aspects of depth of testing can be illustrated in a similar fashion. See the breadth oftesting metric for details on computing coverage and success values.

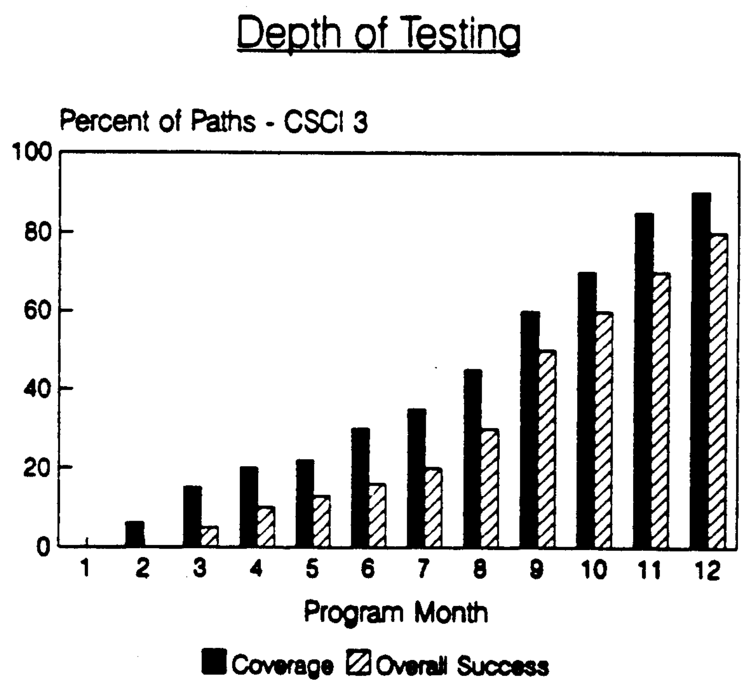

Figure 17-14. Sample Depth of Testing Metric

d. Data requirements: For each module:

(1) CSCI identifier
(2) CSC identifier
(3) CSU identifier
(4) Number of paths
(5) Number of statements
(6) Number of input instances
(7) Number of paths tested
(8) Number of statements tested

(9) Number of input instances tested
(10) Number of decision points tested
(11) Number of paths which have been successfully executed at least once
(12) Number of statements that have been successfully exercised
(13) Number of inputs which have been successfully tested with one legal entry and one illegal entry
(14) Number of decision points (optional)
(15) Number of decision points which have been successfully exercised at least once with all legal classes of conditions and one illegal condition (opt.)

e. Frequency of reporting. Monthly. Report only those modules (CSUs) that have been modified or further tested after their depth of testing values have been reported for the first time. Note: In recognition of the effort required to collect and report this metric, the following rules are offered. Always compute the domain metric as it is relatively straightforward. Compute the path and statement metrics if automated tools exist. If no automated tools exist, compute these two metrics if the module implements a UFD priority one requirement, or if the complexity rules of thumb are exceeded for that module.

f. Use/interpretation.

(1) The depth of testing metric attacks the issue of test coverage, test success, and overall success by considering the paths, statements, inputs and decision points of the software. The trend of these depth of testing metrics over time provides indications of the progress of successful testing, and also test sufficiency.

(2) The metrics are collected at the module or CSU level, but they can be easily extended to the CSC, CSCI, or system level by simply replacing the term "module" in the algorithm definition above with the term "CSC," or "CSCI," or "system". Early in the contractor testing process, it makes more sense to assess depth of testing at the module or CSU level, but later it makes more sense to consider CSCs and CSCIs.

(3) The depth of testing metric can be used to focus attention on those modules which implement high priority UFD requirements.

(4) The depth of testing metric measures should be used in conjunction with requirements traceability, fault profiles, complexity, and the optional development progress metrics. For example, with complexity, the modules of highest complexity could be highlighted for testing (e.g., one might want to test those modules first). They must be used with the breadth of testing metrics to insure that all aspects

of testing are approaching an acceptable state for the Government.

g. Rules of thumb. None.

h. References. Reference (o) of Section III is applicable to this metric.

17-15. Fault profiles metric

a. Purpose/description. Fault profiles provide insight into the quality of the software, as well as the contractor's ability to fix known faults. Note that these insights actually come from measuring the lack of quality (i.e. "faults") in the software. Early in the development process, fault profiles can be used to measure the quality of the translation of the software requirements into the design. Later, they can be used to measure the quality of the implementation of the software requirements and design into code.

b. Life cycle application. Begin after completion of unit testing when software has been brought under configuration control by the developer. Continue through PDSS.

c. Algorithm/graphical display.

(1) Plot the cumulative number of detected and cumulative number of closed software faults as a function of time, as shown in Figure 17-15. One plot should be developed for each priority level as defined in the data requirements section below.

(2) Plot the number of software faults detected and software faults closed per month. This is illustrated in Figure 17-16.

(3) Histograms of open faults by CSCI and priority can be portrayed as in Figure 17-17.

(4) Relative CSCI status with respect to open faults can be shown as in Figure 17-18.

(5) Calculate the average age of STRs as follows: For all STRs, sum the days between the time the current date (if still open). Divide this sum by the fault was opened and either when it was closed or the total number of STRs. This can be displayed as shown in Figure 17-19.

(6) Calculate the average age of closed faults as follows: For all closed STRs, sum the days from the time the STR was opened and when it was closed. Divide this by the total number of closed STRs. This can be calculated for each problem priority or overall.

d. Data requirements. The following information should be derived from all software trouble reports. These data will be used to calculate higher level statistics (described in later paragraphs) as well as to support queries generated as a result of the graphical representations.

(1) Unique identifier

(2) Date written

(3) Descriptive title of problem

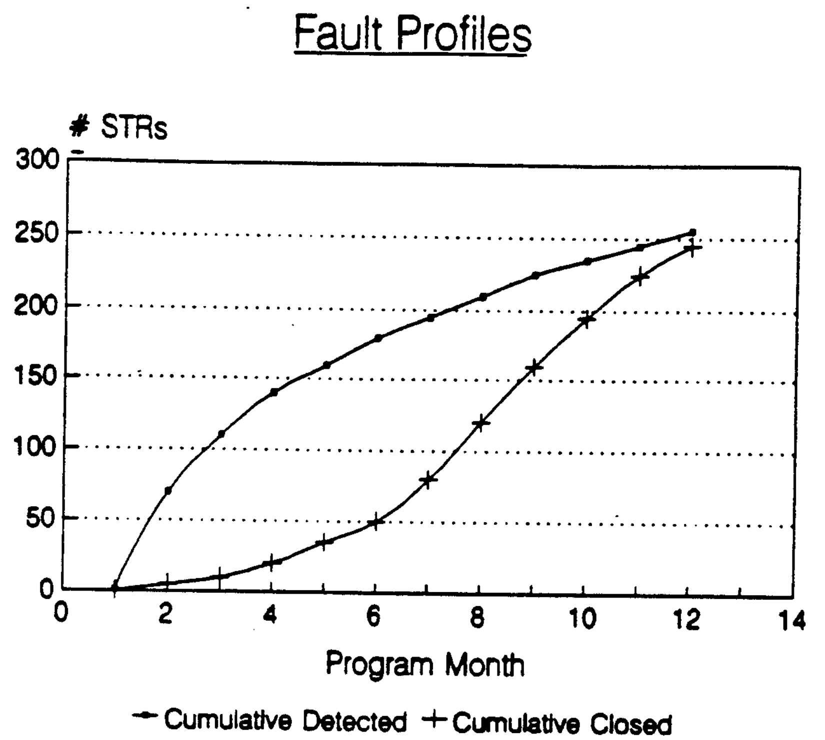

Figure 17-15. Sample Fault Profiles Metric

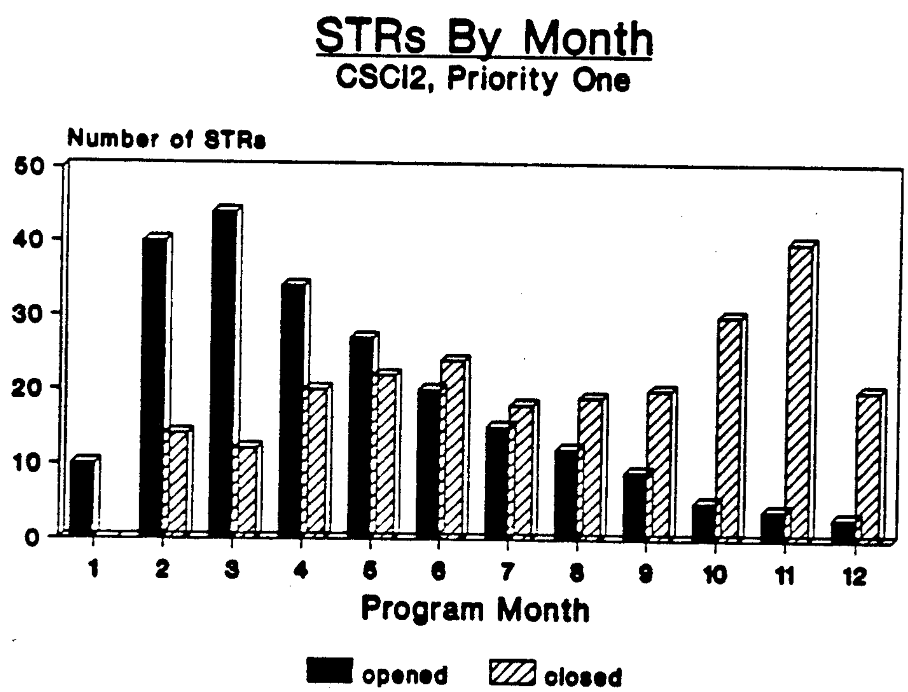

Figure 17-16. Sample of STRs by Month

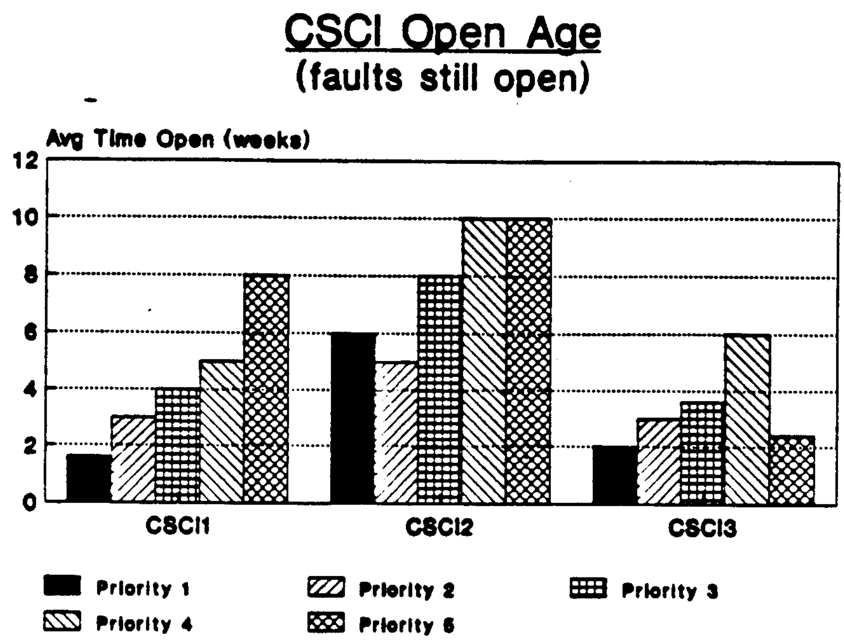

Figure 17-17. Sample of Average Open Age of STRs

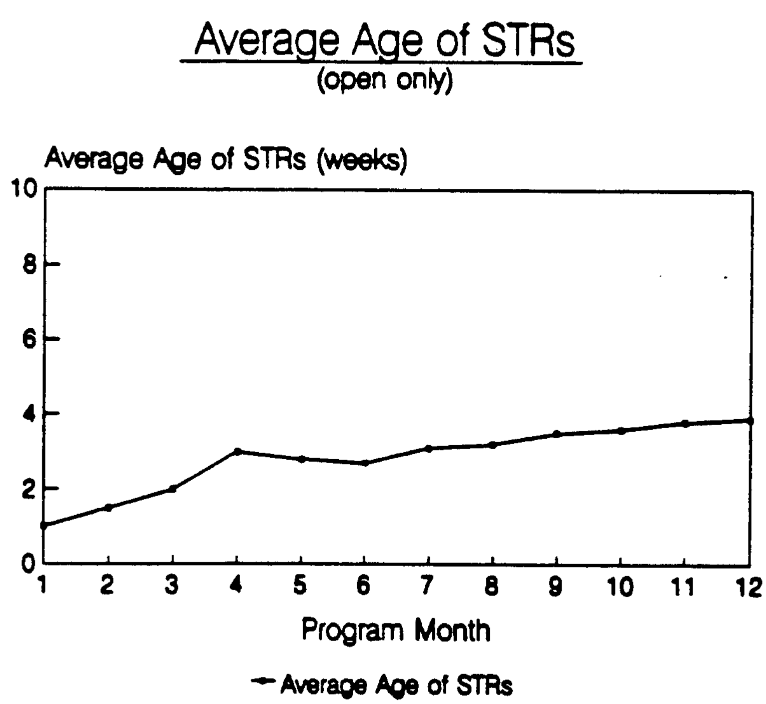

Figure 17-18. Sample of Average Age of Open Faults

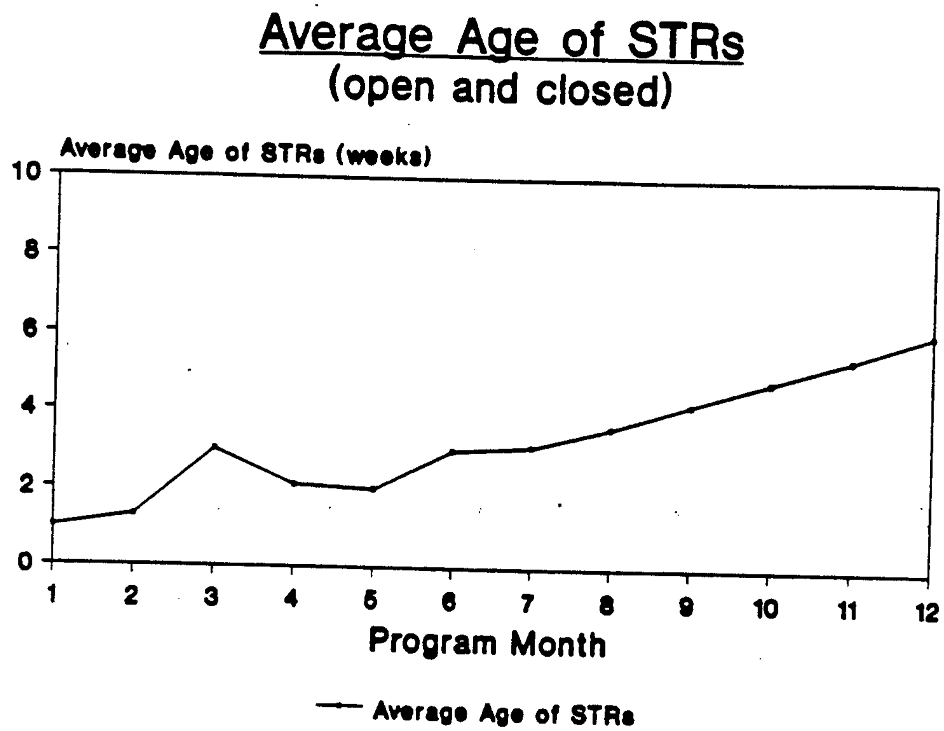

Figure 17-19. Sample of Average Age of All STRs

(4) Detailed description of problem (optional)

(5) Priority:

(a) 1 = causes mission essential function (or operator's accomplishment thereof) to be disabled or jeopardizes personnel safety.

(b) 2 = causes mission essential function (or operator's accomplishment thereof) to be degraded. There is no work around.

(c) 3 = causes mission essential function (or operator's accomplishment thereof) to be degraded. There is a reasonable work around.

(d) 4 = causes operator inconvenience but doesn't affect a mission essential function.

(e) 5 = all other errors

(6) Category:

(a) Requirements
(b) Design
(c) Code
(d) Documentation
(e) Other

(7) When discovered:

(a) Requirements analysis
(b) Design review
(c) Code and unit test
(d) Integration and test
(e) Operation/maintenance

(8) Status:
(a) Open
(b) Duplicate
(c) Closed
(d) Invalid
(9) Date detected
(10) Date closed
(11) Software module (CSU)
(12) CSCI
(13) Software version
(14) Effort to fix (man-hours)
(15) The following rolled-up statistics are the building blocks for the graphical representations of fault profiles. For each CSCI, for each priority:
(a) Cumulative number of STRs
(b) Cumulative number of closed STRs
(c) Average age of closed STRs
(d) Average age of open STRs
(e) Average age of STRs (both open and closed)
(f) Total number of problems for each category (described above)

e. Frequency of reporting. Monthly.

f. Use/interpretation.

(1) There are various aspects of fault profiles that can be examined for insights into quality problems. The most popular type of graphical representation, portrayed in Figure 17-15, displays detected faults and closed (corrected and verified) faults on the same scale. These types of graphs should be examined for each problem priority level, and for each major module or CSCI. Applied during the early stages of development, fault profiles measure the quality of the translation of the software requirements into the design. STRs opened during this phase suggest that requirements are not being defined correctly. Applied later in the development process, assuming adequate testing, fault profiles measure the implementation of requirements and design into code. STRs opened during this stage could be the result of having an inadequate design to implement those requirements, or a poor implementation of the design into code. An examination of the fault category should provide indications of these causal relationships. These examination should be performed as a matter of course in any analysis of fault profiles. One should continuously observe the gap between open and closed faults; if a constant gap or a continuing divergence is observed, especially as a key test or milestone is approached, appropriate action should be taken.

(2) Another use of fault profiles consists of monthly non-cumulative total for each CSCI and priority (Figure 17-16). This can be compared to the amount of

testing done in those months to provide insights into the adequacy of the test program.

(3) Open age histograms (Figures 17-17 and 17-18) can be used to indicate which CSCIs and which priorities are the most troublesome with respect to fixing faults. This may serve to indicate that the developing group for that CSCI may need assistance, whether due to a difficult set of requirements or for some other cause.

(4) Average age graphs (Figure 17-19) can track whether the time to close faults is increasing with time, which may be an indication that the developer is becoming saturated or that some faults are exceedingly difficult to fix.

(5) Caution must be used in interpreting the fault profiles, as the detection of errors is closely tied to the quality of the development and testing process. That is, a low number of detected faults could indicate a good product from a good process or simply a bad process to start with (e.g., one with inadequate testing). Conversely, a large number of faults early on in a program may not be bad. For example, the developer may have an aggressive testing program or may be using techniques such as rapid prototyping with a heavy user involvement to wring out requirements early. A large number of STRs opened in a particular month may be the result of errors detected during a specification review, audit, test, or from use of the software in the field. Thus, the measures cannot be assessed without also considering the measures on breadth and depth of testing. The fault profiles should also be used in conjunction with the metrics for complexity, design stability, and requirements stability.

(6) If the cumulative number of closed STRs remains constant over time and a number of STRs remain open, this may indicate a lack of problem resolution. The age of the open STRs should be checked to see if they have been open for an unreasonable period of time. If so, these STRs represent areas of increased risk. The cause for lack of resolution needs to be identified and corrective action taken.

(7) Once an average STR age has been established large individual deviations should be investigated. There are several reasons why STRs may remain open for a lengthy period of time. One reason could be that the STR is a result of identification of an inadequate requirement which needs to be refined and is undergoing review. An ECP-S may have been written for a problem noted and is waiting resolution. It could also mean that the contractor has failed to take corrective action on the problem. Again, the reasons for lack of problem resolution need to be identified and corrective action taken. The average open age of high priority

faults should also be examined with respect to the time remaining to the next major test or milestone. If the average age of open high priority faults exceeds the time remaining, consideration should be given to delaying the test or milestone until the problems are resolved.

(8) As an option the following method of assessing test adequacy can be used. Rome Air Development Center (RADC) conducted wide research on several software projects and identified the characteristics which have direct impact on system reliability. RADC-TR-87-171 Volumes I and II, "Methodology for Software Reliability Prediction" can be used to predict the number of faults expected to be present per configuration item. Using this information as a guideline, fault profiles can be compared to these estimates to determine if the "peak level" of opened STRs is being approached and that the software development process has matured. As an example, suppose the predicted number of faults is much higher than the actual number of faults reported. If the test coverage metrics are low, this suggests that testing is not complete and the remaining faults are yet to be found. If the test coverage is high this could mean that the software was well written to start with, or that the test cases used were not thorough enough. If the prediction is much less than the actual number of faults, this may indicate a number of problems. The software developer may have an inadequate development effort, may have encountered unexpected design difficulties, have faulty coding or an especially troublesome module(s). The requirements stability metric should be checked and if it is high, this would indicate an immature baseline.

g. Rules of thumb.

(1) The Government should not accept software for any formal system level Government testing until, at a minimum, all priority one and two faults have been closed. Furthermore, a large number of lower priority faults should be examined for a possible cumulative effect on successful test conduct.

(2) If tracking the fault profiles starts early in software development, an average STR open age of less than three months may be experienced. After fielding, this value can rise primarily due to the necessary delays typically experienced in the PDSS process, such as scheduled block releases.

h. References. References (c), (h), (i), and (t) of Section III are applicable to this metric.

17-16. Reliability metric

a. Purpose/description.

(1) One aspect of the reliability metric is to assess the contribution of software to the overall

system mission failure rate based on the number of failures expected when the software is used in its intended environment.

(2) Another aspect of reliability is an assessment of the length of system downtime associated with software failures. This deals with the time it takes to restore the system for use and is analogous to hardware mean time to repair (MTTR).

(3) There are many analytical models available to estimate software reliability as a function of test time. These reliability models have the benefit of illustrating the improvement in software reliability over time and can provide estimates of total test time required, based on a failure rate, before a reliability objective is met. Successive estimates of the failure rate are normally obtained from the cumulative probability distribution of the failures. One of the principal reasons no single model is endorsed here is due to the lack of consensus regarding the particular pattern or distribution associated with the software failures of a particular system. Although no single reliability model can be trusted to faithfully represent future software performance in all circumstances, the judicious selection of a model which closely approximates the actual behavior of the software can significantly aid in the estimation of future reliability performance.

b. Life cycle application. See paragraph 17-15b for collecting fault profile data. Begin collecting the remainder of reliability metric data during system level testing.

c. Algorithm/graphical display.

(1) The selection of a reliability model is based on several factors: the length of the reliability test, how a software failure is defined, the adequacy of the operational profile, as well as the assumptions underlying the use of each model. For example, the Nonhomogenous Poisson Process (NHPP) model, is suitable for many cases of reliability growth measurement, but involves the acceptance of some basic assumptions. "Poisson" refers to a particular probability distribution of the software failures, while "non-homogenous" indicates that the characteristics of the Poisson distribution will vary over time. The NHPP also assumes that faults at a given level of severity contribute about equally to the failure rate, therefore the repair of each fault will also have about an equal effect on the failure rate. This means that the NHPP is well suited for a testing environment in which repairs are conducted in response to software failures leading to a steadily decreasing rate of software failures as exhibited in Figure 17-20.

(2) Not all operational environments are suited for the NHPP. Once a selected analytical model is

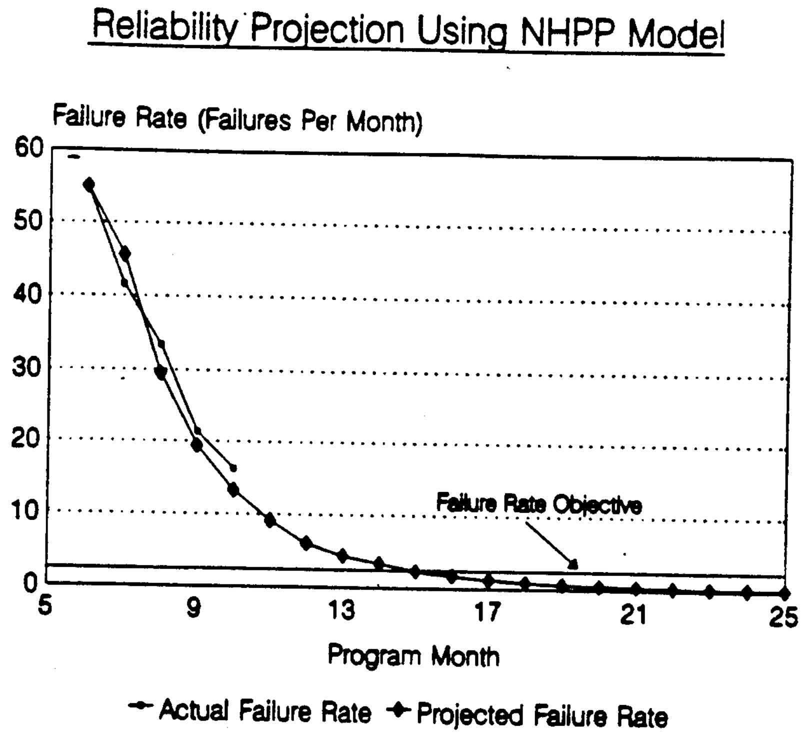

Figure 17-20. Sample Reliability Model Projection

applied, it is important to determine how closely the past predictions from a particular model for a particular data set reflect the actual behavior for that data set. Various statistical and qualitative methods can be employed to determine the degree of commonality between the two data sets. If it is determined that the selected model is not an accurate reflection of the actual behavior then apply other models until a good fit is achieved. The most comprehensive collection of prediction models is available within the Statistical Modeling and Estimation of Reliability Functions for Software (SMERFS) software package developed by the Government. Other software tools are also provided within SMERFS to compare a model's prediction of the behavior of a software application with the actual behavior of that software. Data requirements on software faults used as input to the analytical models are described in the fault profiles metric, paragraph 17-15.

(3) Use fault profile metrics throughout development to observe trends in the type of faults occurring and their rates of closure.

(4) Other software reliability data will be reported as test incident reports (TIRs) which are chargeable to software. All calculations to derive software reliability values (point estimates, lower

confidence bounds, mean times, median times, and maximum values) is performed using the procedures and formulas which have been established for calculating all other TIR data in accordance with Part One of DA Pamphlet 73-1.

(5) - After turnover to the Government for DT and OT, compute the following items only when the software is being used and stressed in accordance with its Operational Mode Summary/Mission Profile (OMS/MP).

(a) Determine the computed point estimate of mean time between mission failures caused by system hardware or software as measured during the test event.

(b) Calculate the 80% lower confidence bound value of mean time between mission failures caused by system hardware or software.

(c) Determine the computed point estimate of mean time between mission failures caused by software as measured during the test event.

(d) Calculate the 80% lower confidence bound value of mean time between mission failures caused by software.

(e) Compute the mean time to restore the system to operational condition after a software-caused system failure has occurred. Note: In the calculations of restoration times for this metric, the time to restore should include the time it takes to reinitialize the system and recover lost data.

(f) Compute the median time to restore the system to operational condition after a software-caused system failure has occurred.

(g) Calculate the maximum 95th percentile value of time to restore the system to operational condition after a software-caused system failure has occurred.

(5) Figure 17-21 shows computed point estimates of system mean time between mission failures, the required specification value and associated 80% lower confidence bound plotted over two test events. Check at each failure if the trend is towards the specification value. Do not proceed to OT unless the computed MTBF is greater than the lower 80% confidence bound.

(6) Figure 17-22 shows the computed mean, median and 95th percentile times to restore the system to operational status. They are plotted against their corresponding specification values. The desired trend is for the computed values over time to be less than or equal to their specified values.

d. Data requirements.

(1) All data requirements from the fault profiles metric

(2) Measured software failure rate

(3) Projected software failure rate

(4) Software failure rate objective

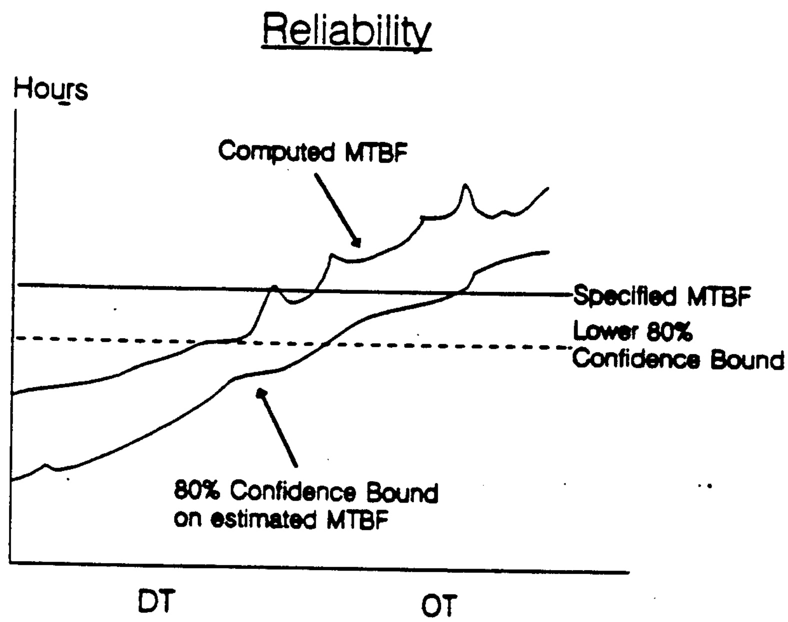

Figure 17-21. Sample Mean Time Between Mission Failures

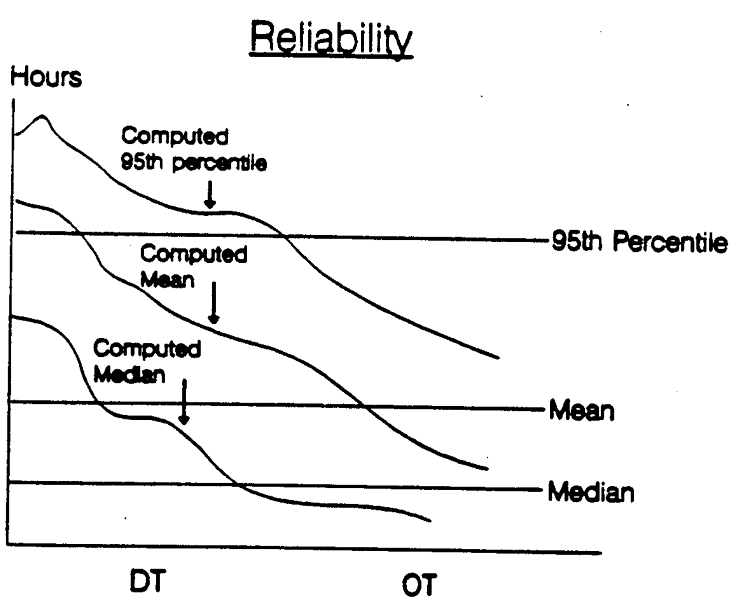

Figure 17-22. Sample Mean Time to Restore System

(5) All reliability, availability, and maintainability incident data from test events

(6) Test identification (such as Reliability Growth Test (RGT), Developmental Test (DT) and Operational Test (OT))

(7) The required specification value of system Mean Time Between Mission Failure (MTBF)

(8) - The required specification values for mean, median and maximum 95th percentile mean time to restore the system to operational status.

e. Frequency of reporting.

(1) Fault profile information - see paragraph 17-15e.

(2) Monthly for data based on fault profile information and reliability modeling.

(3) Government DT/OT - gather data in real time as incidents occur and report monthly.

f. Use/interpretation.

(1) Fault profile metrics indicate rates at which faults are being reduced and thus reliability increased. One also needs to simultaneously consider the test coverage metrics. The fault profile information, however, says nothing about how often the faults remaining in the software will be encountered by the user.

(2) While many arguments can be made that mean time between failure is an inappropriate measure, it is more than adequate for estimating how often one can expect the software to "fail" in a field environment as long as inputs are of the type and in relative proportion to what will be encountered in field use and modules are exercised with the relative frequency expected in a tactical environment. Measuring MTBF only when the system and software are being used in accordance with the OMS/MP insures the above conditions.

(3) When using fault profiles as a reliability measure, refer to the use and interpretation guide previously given for fault profiles.

(4) Using the NHPP algorithm, progress can be tracked using various reliability growth techniques. In cases where the system MTBF is not meeting its requirement, the overall failure rate of the software can be analyzed by using this model and the contribution of software to the system failure rate can be investigated by other means.

g. Rules of thumb. No formal thresholds are given. However, the Government should not accept the software until the fault profile open anomaly curve flattens out, closure of anomalies approaches the open anomalies, and a high degree of breadth and depth of testing have been demonstrated. Do not proceed to OT until system level MTBF (inclusive of both hardware and software) have been demonstrated with high confidence in DT.

h. References. References (k), (m) and (u) of Section III are applicable to this metric.

Section II
Optional Metrics

17-17. Manpower metric

a. Purpose/description. This measure provides an indication of the developer's application of human resources to the development program and ability to maintain sufficient staffing to complete the project. It can also provide indications of possible problems with meeting schedule and budget. It is used to examine the various elements involved in staffing a software project. These elements include the planned level of effort, the actual level of effort, and the losses in the software staff measured per labor category. Planned manpower profiles can be derived from the appropriate planning documents submitted to the Government. These are usually provided in the contractor's proposal or the software development plan. The planned level of effort is the number of labor hours scheduled to be worked on a CSCI each month. The planned levels are compared with the actual levels over a given time period. Deviations between planned and actual levels are monitored to ensure that the developer is meeting the necessary staffing criteria.

b. Life cycle application. Track for entire length of development (including PDSS).

c. Algorithm/graphical display. The sample graph shown in Figure 17-23 depicts the manpower metric for an entire system over all labor categories. Figure 17-24 is an example of a staffing profile.

d. Data requirements.

(1) Software planning documents reflecting expected staffing profiles and labor hour allocations.

(2) For each labor category tracked:

(a) Labor category name

(b) For each experience level (experienced, special, total):

- number of personnel planned to be on staff for the next reporting period
- number of personnel actually on staff in the current reporting period
- number of unplanned losses in personnel that occurred
- number of labor hours that are planned to be expended in the next reporting period (cumulative)
- number of labor hours actually expended in the current reporting period (cumulative)

e. Frequency of reporting. Monthly.

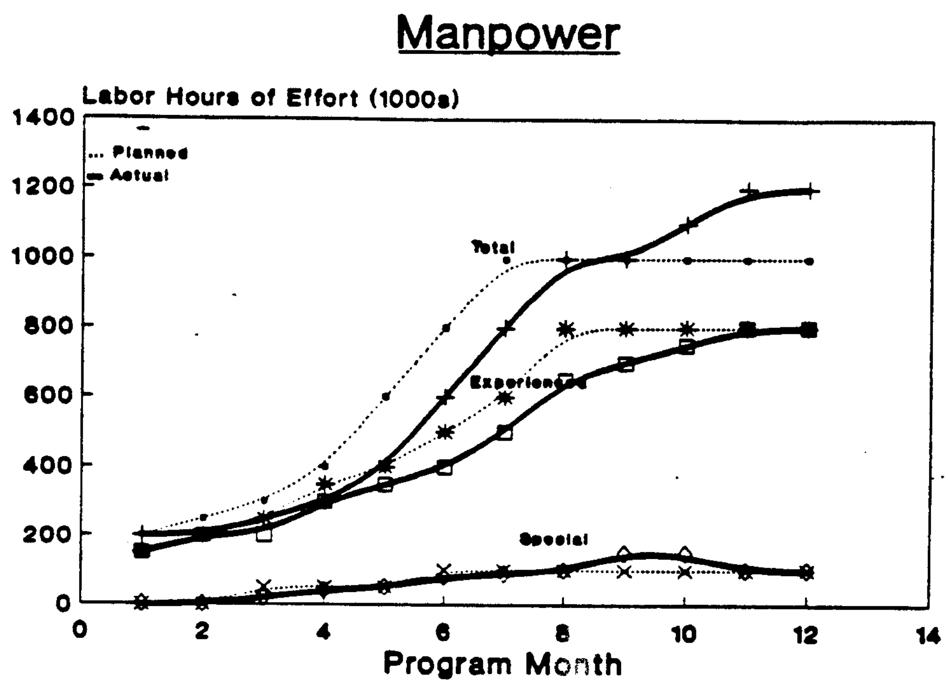

Figure 17-23. Sample Manpower Metric

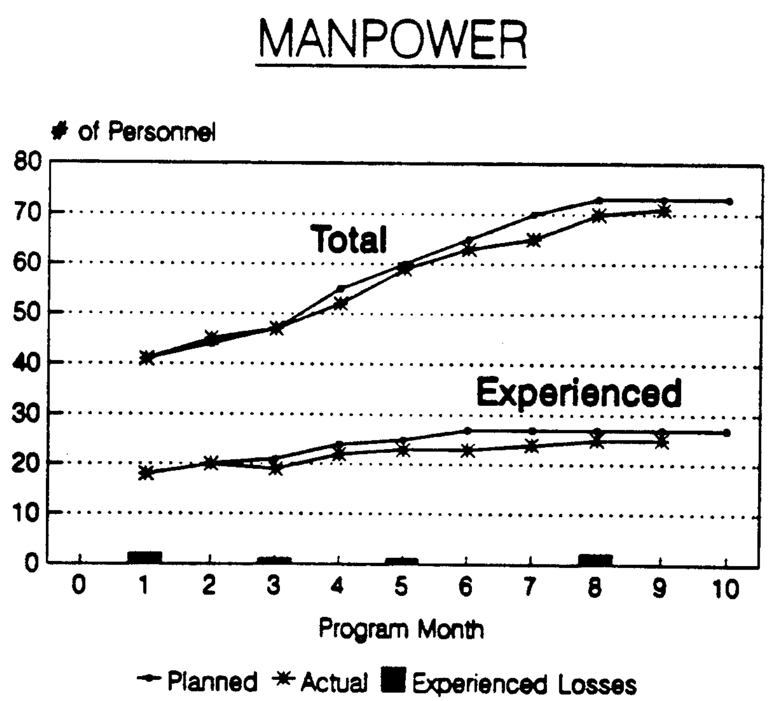

Figure 17-24. Sample Staffing Profile

f. Use/interpretation.

(1) Special skills personnel are those individuals who possess specialized software-related abilities defined as crucial to the success of the particular system. For example, Ada programmers or artificial intelligence experts might be considered special skills personnel for one project, but not necessarily for another project.

(2) Experienced personnel are defined as those individuals with a minimum of three years experience in software development for similar applications.

(3) Total personnel are the sum of experienced and inexperienced personnel. Special skills personnel are counted within the broad categories of experienced and inexperienced, but are also tracked separately.

(4) Tracking by individual labor category can be done for programs with large staffs or to monitor aspects of a program which are deemed worthy of special attention. For many projects, software quality assurance people might be tracked as a separate category.

(5) The software staff includes only those engineering and management personnel directly involved with software system planning, requirements definition, design, coding, integration, test, documentation, configuration management, and quality assurance. Losses and gains for each category specified above should be tracked monthly to indicate potential problem areas. Personnel who have been replaced are still counted as a loss. High turnover of experienced personnel can adversely affect project success. Also, for example, adding many personnel (beyond those numbers planned) late in the development process may provide an indication of impending problems. Turnover of key people must also be watched closely.

(6) Significant deviations from planned levels indicate potential problems with staffing the various software development activities. Deviations between actual and planned levels can be detected, explained and corrected before they negatively impact the development schedule. The losses in the staff can be monitored to detect a growing trend or significant loss of experienced staff. This indicator assists the Government in determining whether the developer has scheduled a sufficient number of employees to produce the product in the time allotted.

(7) The shape of the staff profile trend curve tends to start at a moderate level at the beginning of the contract, grow through design, peak at coding/testing and diminish near the completion of integration testing. Individual labor categories, however, are likely to peak at different points in the life cycle. The optimum result would show little deviation between the planned and actual levels for

each category with losses kept to a minimum. Specific attention should be paid to any case where there is a significant deviation (plus or minus 10%) between actual and planned values. If the actual value is 10% or more than the planned value, this may suggest that the developer:

(a) Underestimated the work involved.

(b) Found out that the task was more complicated than expected.

(c) Did not perform the work efficiently.

(d) Is ahead of schedule.

(e) Is behind schedule and is adding manpower to catch up.

(f) Is adding people to make up for a lack of experienced ones.

(8) If the actual levels are less than planned levels, this may suggest that the developer:

(a) Overestimated the work involved.

(b) Did not perform the task completely.

(c) Did not accurately determine the complexity of the effort.

(d) Performed the work efficiently.

(e) Did not assign adequate manpower to the task.

(f) Misinterpreted the task or requirements.

(g) Is ahead of schedule.

(9) In cases of large deviation the developer should be required to determine the cause and report any corrective actions necessary.

(10) The manpower metrics are used primarily for project management and do not necessarily have a direct relationship with other technical and maturity metrics. For example, manpower levels are usually higher during testing activities. This does not necessarily reflect an increase in the quality levels of the product or suggest that the depth of testing metrics will be higher.

(11) The manpower metrics should be used in conjunction with the development progress, test coverage and cost metrics.

(12) The value of this metric is somewhat tied to the accuracy of the developer's development and staffing plan, as well as to the accuracy of the labor reporting system.

g. Rules of thumb.

(1) A high ratio of total to experienced personnel is undesirable. A ratio of 3:1 is typical.

(2) Significant deviations from the planned staffing profile, as well as a high turnover rate in any category, should be investigated so as to minimize risk to the Government.

(3) When 80% of the planned or budgeted resources have been expended, that fact should be highlighted to the Government and documented in the

monthly reports. Closer attention should then be paid to the remaining resources.

h. References. References (a), (b), (g) and (s) of Section III are applicable to this metric.

17-18. Development progress metric

a. Purpose/description. The development progress metrics provide indications of the degree of completeness of the software development effort, and can be used to judge readiness to proceed to the next stage of software development.

b. Life cycle application. Begin collecting at SRR and continue for the entire software development phase.

c. Algorithm/graphical display.

(1) A sample of the development progress metric is shown in Figure 17-25.

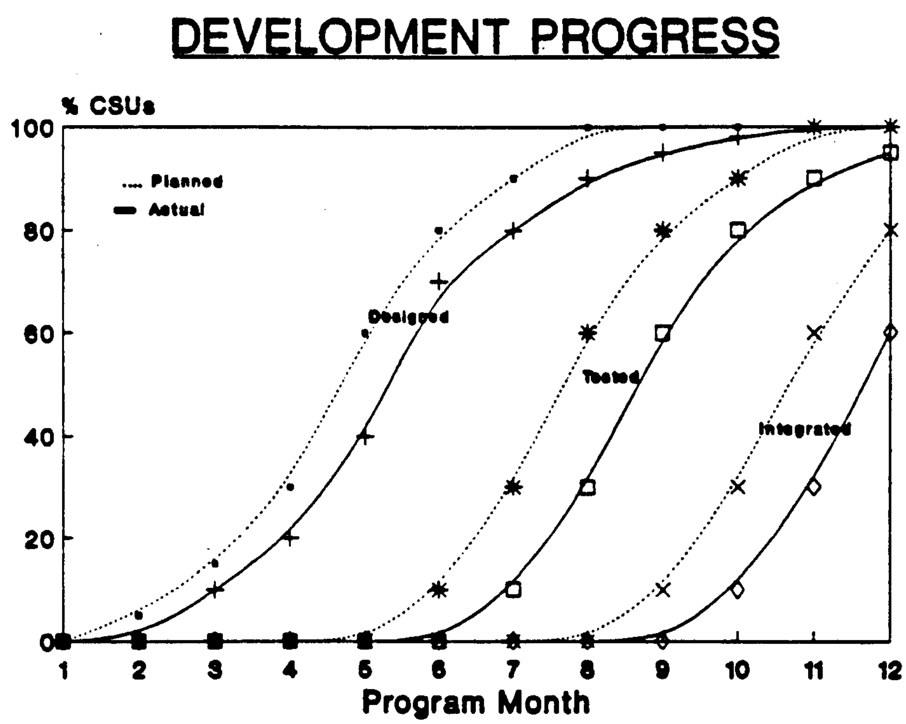

Figure 17-25. Sample Development Progress Metric

(2) The following calculations can be performed at either the CSC, CSCI, or system level.

(a) Compute percent of CSUs 100% designed.

(b) Compute percent of CSUs 100% coded and successfully unit tested.

(c) Compute percent of CSUs 100% integrated.

(3) Additionally, using the requirements traceability matrix, one can plot functionality (which has been developed and verified) versus time as a measure of development progress.

d. Data requirements.

(1) CSCI/CSC/CSU development, test and integration schedules

(2) For each CSCI:

(a) Number of CSUs per CSCI

(b) Number of CSUs 100% designed and reviewed by the Government (cumulative)

(c) Number of CSUs 100% coded and successfully unit tested (cumulative)

(d) Number of CSUs 100% integrated into a CSC or CSCI (cumulative)

(e) Number of CSUs planned to be 100% designed and reviewed by the Government for the next reporting period (cumulative)

(f) Number of CSUs planned to be 100% coded and successfully unit tested for the next reporting period (cumulative)

(g) Number of CSUs planned to be 100% integrated into a CSC or CSCI for the next reporting period

e. Frequency of reporting. Monthly.

f. Use/interpretation.

(1) "Successfully" tested is defined as completing all test cases (required test coverage and depth) with no defects. "Integrated" is defined as being actually and logically connected (in a static sense) with all required modules. (Dynamic tasking is not considered here).

(2) Design, coding, unit testing, and integration of CSUs should progress at a reasonable rate. Plotting the progress in these three categories versus what was originally planned can indicate potential problems with schedule and cost. In certain instances, consideration must be given to a possible re-baselining of the software (e.g., in an evolutionary approach) or if one simply must add modules due to changes in the requirements.

(3) The development progress metrics should be used with the test coverage metrics (breadth and depth of testing) to assess the readiness to proceed to a formal Government test. They should also be used with the requirements traceability metrics so that progress can be tracked in consonance with the tracing of requirements. Additionally, it can be used with the schedule metric to help evaluate schedule risk.

(4) The development progress metrics should be used with the manpower metrics to identify areas where the developer is experiencing problems. Also, using these metrics with the computer resource utilization metrics can ensure that the actual utilization is representative of a complete system. Finally, special attention should be given to the development progress of high complexity CSUs.

(5) These metrics pass no judgement on whether the objectives in the development plan can be achieved.

g. Rules of thumb.

(1) One hundred percent (100%) of all CSUs should be designed prior to proceeding beyond CDR for the appropriate CSCI.

(2) One hundred percent (100%) of all CSUs should be coded, successfully tested, and integrated before proceeding to a formal system level Government test.

h. References. References (a) and (g) of Section III are applicable to this metric.

Section III
Metrics References

17-19. References

Additional detail and related materials on the metrics described in this chapter can be found in these publications.

a. AFSCP 800-43, Software Management Indicators, Air Force Systems Command, 31 January 1986.

b. AMC-P 70-13, Software Management Indicators, Management Insight, 31 January 1987.

c. AMC-P 70-14, Software Quality Indicators, 20 January 1987.

d. ARPAD-TR-88005, The Complexity Analysis Tool, October 1988.

e. CMU/SEI-87-TR-23, A Method for Assessing the Software Engineering Capability of Contractors, Carnegie-Mellon University Software Engineering Institute Technical Report, September 1987.

f. DA Pam XX-XX, Operational Requirements for Automated Capabilities (Draft), 2 January 1992.

g. ESD-TR-85-145, Software Reporting Metrics, The Mitre Corporation, MTR 9650 Revision 2, November 1985.

h. IEEE Standard 982.1-1988, IEEE Standard Dictionary of Measures to Produce Reliable Software, 30 April 1989.

i. IEEE Standard 982.2-1988, IEEE Guide for the Use of IEEE Standard Dictionary of Measures to Produce Reliable Software, 12 June 1989.

j. MIL-HDBK-WBS.SW, Work Breakdown Structure for Software Cost Reporting (Draft), 1 October 1991.

k. NAVSWC TR 84-373, Statistical Modeling and Estimation of Reliability Functions for Software (SMERFS) Users Guide Revision 2, March 1991.

l. NBS 500-99, Structured Testing: A Software Testing Methodology Using the Cyclomatic Complexity Metric, National Bureau of Standards, December 1982.

m. RADC-TR-82-263, Software Reliability Modelling and Estimation Techniques, Rome Air Development Center, October 1982.

n. Beizer, Boris, Software System Testing and Quality Assurance, Van Nostrand Reinhold, 1984.
o. Buckley, Fletcher J., Standard Set of Useful Software Metrics Is Urgently Needed, Computer, July 1989.
p. Craig, Measuring Effectiveness and Adequacy of System Testing, Conference Proceedings, Software Test and Validation, National Institute for Software Quality and Productivity, Inc., September 1987.
q. Design Complexity Metrics, T.J. McCabe & Associates, Inc., May 1988.
r. Draft Guide for the Use of Standard Dictionary of Measures to Produce Reliable Software, IEEE Computer Society, May 1988.
s. Revised Implementation Guidelines for Software Management and Quality Indicators for AFATDS, 30 July 1989.
t. Software Engineering Institute Quality Subgroup Working Papers, untitled, November 1989.
u. Software Measurement Models, Data & Analysis Center for Software, July 1987.
v. Walsh, A Software Reliability Study Using a Complexity Measure, 1982.

Appendix A

Section I
Required Publications

AR 73-1, Test and Evaluation Policy, dated 6 DEC 90. Cited throughout this part of DA Pamphlet 73-1. Cited on pages 1-1, 1-4, 1-5, 1-6, 1-8, 1-11, 2-1, 3-10, 3-12, 3-14, 5-1, 5-5, 5-11, 8-1, 9-3, 11-3, 11-4, 11-6, 12-2, 14-1, 15-1, 15-4, and 17-1.

AR 380-19, Information Systems Security, dated 4 SEP 90. Cited on page 3-8.

DA Pamphlet 73-1, Part One, Test and Evaluation Procedures Guide. Cited on page 17-50.

DA Pamphlet 73-1, Part Two, Test and Evaluation Master Plan (TEMP) Format, Review and Approval Procedures. Cited on pages 4-10 and 5-5.

DA Pamphlet 73-1, Part Three, Critical Operational Issues and Criteria (COIC) Development, Review and Approval Guidelines. Cited on page 5-4.

DA Pamphlet 73-1, Part Four, Developmental Test and Evaluation (DT&E) Guidelines. Cited on pages 5-6, 5-7, 8-1 and 14-1.

DA Pamphlet 73-1, Part Five, Operational Test and Evaluation (OT&E) Guidelines. Cited on Pages 5-6, 5-10, 5-11, 5-12, 9-3, 9-4, and 15-2.

Section II
Related Publications

AFOTECP 800.2, Volume 4, Software Usability Evaluator's Guide.

AR 15-38, Test Schedule and Review Committee.

AR 25-1, The Army Information Resources Management Program.

AR 25-3, Army Life Cycle Management of Information Systems.

AR 25-5, Information Management with a Sustained Base.

AR 40-60, Policies and Procedures for the Acquisition of Medical Materiel.

AR 70-1, Systems Acquisition Policy and Procedures.

AR 70-15, Materiel Change Management.

AR 70-25, Use of Volunteers as Subjects of Research.

AR 70-37, Configuration Management.

AR 71-9, Materiel Objectives and Requirements.

AR 105-7, Army Training and Audio-Visual Support.

AR 350-38, Training Device Policies and Management.

AR 525-1, Strategic Systems.

AR 700-142, Materiel Release.

CMU/SEI-87-TR-23, A Method for Assessing the Software Engineering Capability of Contractors, Carnegie Mellon University Software Engineering Institute Technical Report.

DA Pamphlet 25-6, Configuration Management for Automated Information Systems.

DA Pamphlet 700-142, Materiel Release.

DA Pamphlet XX-XX, Operational Requirements for Automated Capabilities (Draft).

DI-A-7089, Conference Minutes.

DI-MCCR-80014A, Software Test Plan.

DI-MCCR-80015A, Software Test Description.

DI-MCCR-80017A, Software Test Report.

DI-QCIC-80572, Software Quality Program Plan.

DI-S-30559, Technical Operating Report (TOR).

DOD-STD-1467A, Post-Deployment Software Support.

DOD-STD-1838, Common Ada Programming Support Environment Interface Set (CAIS).

DOD-STD-2167A, Defense Systems Software Development.

DOD-STD-2168, Defense System Software Quality Program.

DOD-STD-7935A, DOD Automated Information System (AIS) Documentation Standards.

DODD 3405.1, Computer Programming Language Policy.

DODD 3405.2, Use of Ada in Weapons Systems.

DODD 5000.1, Defense Acquisition.

DODD 7920.1, Life-Cycle Management of Automated Information Systems (AISs).

DODI 5000.2, Defense Acquisition Management Policies and Procedures.

DODI 7000.2, Performance Measurement for Selected Acquisitions.

DODI 7920.2, Automated Information Systems (AIS) Life-Cycle Management Review and Milestone Approval Procedures.

DODI 7920.4, Baselining of Automated Information Systems (AISs).

MIL-HDBK-245B, Writing Statements of Work (SOWs).

MIL-HDBK-WBS.SW, Work Breakdown Structure for Software Elements (Second Draft).

MIL-STD-480B, Configuration Control - Engineering Changes, Deviations and Waivers.

MIL-STD-490A, Specification Practices.

MIL-STD-881B, Work Breakdown Structures for Defense Materiel Systems.

MIL-STD-1521B, Technical Reviews and Audits for Systems, Equipments, and Computer Software.

MIL-STD-1815A, Ada Programming Language.

NBS 500-99, Computer Science and Technology: Structured Testing: A Software Testing Methodology Using Cyclomatic Complexity Metric.

OMB Circular A, Purchases of ADP Equipment.

RADC-TR-87-171, Volumes 1 and 2, Methodology for Software Reliability Prediction.

Appendix B
Statement of Work (SOW)

B-1. Statement of Work description

a. Software test and evaluation is an emerging technology for which specific requirements are not well-defined in existing military specifications and standards. Specific tasks for planning and executing software T&E must be tailored to the technical and management characteristics of each software development. The statement of work (SOW) defines the work tasks and services which must be performed in the T&E program for software development.

b. MIL-HDBK-245B, Notice 1 of 31 December 1989 provides formal requirements for developing and implementing the SOW. The SOW provides all that information which cannot be defined in the limited scope of technical specifications and contract data requirements lists (CDRLs). Specifications are limited to descriptions of technical and performance requirements of the software products. CDRL items are limited to describing data to be submitted during the software development. Examples of information which can be presented in an SOW for software T&E are: background information, program management objectives, software technical objectives, and software functional needs.

c. The SOW is part of a binding legal document, a contract, and must be prepared carefully and accurately. Errors and shortcomings can be costly to correct.

B-2. Statement of Work criteria

a. In order to impact the specific software development tasks, software T&E personnel must be involved in developing the SOW. Specific items which should be addressed by software T&E personnel in SOW development are:

(1) Distribution of CDRL items on a DD Form 1423 should include independent evaluators, the PM's software matrix support activity, PDSS-LCSEC/CDA personnel;

(2) Software tests must permit derivation of data which support stated software maturity measurements and the selected metrics set;

(3) Contracted software testing must provide usable data for Government evaluations.

b. Some specific software T&E issues which should be addressed in all SOWs for software development are provided in checklist form in Figure B-1. Checklist items with a subjective score of four or less should be clarified or elaborated.

B-3. Sample SOW paragraphs

A selection of sample software related SOW paragraphs is provided for reference. These may be tailored individually, or as logical groups dependent on acquisition needs. Some paragraphs require system-specific values to be inserted. Paragraphs dealing with different aspects of the same area, such as growth capacity and stress testing, should be coordinated to avoid duplicating or conflicting requirements.

a. Software Reviews and Audits: The contractor shall host system and software reviews and audits IAW MIL-STD-1521B (i.e., SRR, SDR, SSRs, PDRs, CDRs, TRRs, FCA/PCA), as applicable. Reviews shall be iterative and conducted at action officer levels. PDRs and CDRs shall provide demonstrations for user review during these events. Software and documentation necessary to support these reviews shall be submitted to the Government in a timely manner, so as to allow for Government review and preparation. Reviews shall be held as iterative working group efforts among Government action officers and contractor personnel. Results of formal reviews and audits shall be reported in accordance with DI-A-7089.

b. Software Quality Program: The contractor shall develop and implement a software quality program IAW DOD-STD-2168 to complement the software development. The software quality program shall be documented IAW DI-QCIC-80572 and submitted to the Government for approval.

c. Software Quality Indicators: The contractor shall establish procedures and methodologies to gather and evaluate data to implement software quality metrics based upon the quality indicators defined in DA Pamphlet 73-1, Part Seven, Chapter 17. The metrics shall be tailored to the software development. The contractor shall describe the methodologies and procedures used to implement the software quality metrics in the software development plan. Metrics reports shall be prepared IAW (insert the appropriate DIDs from Appendix C).

d. Software Management Indicators: The contractor shall establish procedures and methodologies to gather and evaluate data to implement the cost, schedule and computer resource utilization software management metrics based upon management indicators defined in DA Pamphlet 73-1, Part Seven, Chapter 17. The metrics shall be tailored to the software development. The contractor shall describe the methodologies and procedures used to implement the software management metrics in the software development plan. Metrics reports shall be prepared IAW (insert the appropriate DIDs from Appendix C).

e. Software Requirements Metrics: The contractor shall establish procedures and methodologies to gather

and evaluate data to implement software requirements metrics (requirements traceability and requirements stability) based on metrics indicators defined in DA Pamphlet 73-1, Part Seven, Chapter 17. The metrics shall be tailored to the software development. The contractor shall describe the methods and procedures used to implement the software requirements metrics in the software development plan. Metrics reports shall be prepared IAW (insert the appropriate DIDs from Appendix C).

f. Software Security: The security level for the software is ______ (insert applicable security level), as defined in AR 380-19. The contractor shall identify applicable design requirements to meet the security level for this software development, including the physical security classification requirements for documentation, software security provisions for any classified computer interface, and access to and storage of classified computer information.

g. Quantification of Software Reliability: The contractor shall identify all software/code related anomalies, and determine if they fall under any of the following categories:

(1) Operational Mission Failures (OMF) (Priority 1 and 2) - those which would have caused an OMF in the fielded system.

(2) Non-OMF (Priority 3) - those which would have caused a significant degradation of mission functionality in the fielded system but not an OMF.

These two categories of anomalies shall be separately documented and reported to the Government, on a monthly basis, with a rationale for the selection of the category for each anomaly. In addition, each OMF and non-OMF anomaly shall be reported documenting the frequency of occurrence in units, based on application (i.e., cycles of ballistic computations, time for communications processing, miles for navigation processing, etc.). This data will be analyzed by the Government in generation of software reliability.

h. Independent Verification and Validation (IV&V): The Government reserves the right to perform, or have a designated representative perform, IV&V of the software being developed under this effort at any time during the contract period. The contractor shall ensure Government/IV&V agent interface and data exchange in support of any IV&V activity. To accomplish this, the contractor agrees to provide access to any and all facilities, security clearance, data, documentation, plans, software development folders/files, and applicable software code necessary to satisfy the purpose and objectives of the IV&V. The Government will notify the contractor at least five (5) working

days prior to any IV&V activity and will state the purpose and objectives of the IV&V activity.

i. Software Cyclomatic Complexity: The contractor shall comply with the following software complexity requirements IAW NBS 500-99. The software cyclomatic complexity shall not exceed a complexity limit of seven for the PDL and nine for source code derived from the PDL. A software unit, modified by corrective action in satisfaction of any problem/change report, software trouble report (STR), or other record, shall not exceed a complexity limit of twelve. The contractor shall submit a summary of cyclomatic complexity with the rationale to the Government for comment and approval at the program reviews, as specified herein. The complexity shall be computed and documented along with the documentation of PDL, code and software change requests, and shall include statements detailing the rationale for any modules exceeding the above complexity limits. The cyclomatic complexity metric shall be applied during unit and/or module level testing, as described in NBS 500-99. Identificati... paths and their corresponding test case/drivers shall be documented in the software development folders (SDFs) or program folders (PFs).

j. Software Tools: The contractor shall identify all CASE tools used during the software development effort and document them in the software development plan (SDP). CASE tools must be used during the Ada software development process. These CASE tools shall support the design, coding, documentation, configuration management and unit/system test needed for CSCI/HWCI development as specified in DOD-STD-2167A. The contractor shall identify any other software tools that are required and shall maximize compatibility with DOD-STD-1838, "Common Ada Programming Support Environment Interface Set (CAIS)." The contractor shall also use DOD-STD-1467A as a guide for these efforts.

k. Test Hooks: The contractor shall incorporate test hooks (software test points) into the operational code. These test hooks are required to permit the diagnosis of hardware, software and operator induced faults, and to evaluate hardware/software performance by providing the capability to monitor the process and flow within the software. The contractor shall identify the interfaces and monitoring/recording provisions (hardware and software) that are designed in the embedded operational code, which allow the use of test software in the evaluation of the operational system, and shall document these in an engineering report in contractor format. The test hardware and software used to access these test hooks for the evaluation of the operational system shall be documented in this report.

l. Software Testing: The contractor shall develop, implement, and maintain a comprehensive software test program IAW DOD-STD-2167A. The contractor responsibility includes all information required for CSCI-level testing, level A, level B, and formal qualification testing (FQT). These tests shall be completed prior to Government Developmental Test. This information shall be documented in the software test plan (STP) (DI-MCCR-80014A) and the software test description (STD) (DI-MCCR-80015A). Both documents shall be delivered to the Government for approval.

m. Unit Level Testing: The contractor shall perform testing at the unit level, including regression testing. Units shall be tested prior to integration with other software. Unit level test information, including identification of test paths and their corresponding test cases/drivers and test results, shall be maintained in the software development folders (SDFs). The contractor shall regression test all code utilizing paths generated from the cyclomatic complexity method defined in NBS 500-99. The paths chosen shall completely exercise all new/modified code and requirements. The Government shall have complete access to the SDFs.

n. CSC Level Testing: The contractor shall perform testing at the CSC integration level, including regression testing. The contractor shall use unit/CSC interrelationship diagrams or compiler-generated cross-reference listings and perform regression tests accordingly. The contractor shall test all units subordinate to the modified unit to assure that a change did not result in performance degradation. CSC-level test information, including identification of test paths and their corresponding test cases/drivers and test results, shall be maintained in the SDFs. The contractor shall regression test all code utilizing paths generated from the cyclomatic complexity method defined in NBS 500-99. The paths chosen shall completely exercise all new/modified code and requirements. The Government shall have complete access to the SDFs.

o. Formal Qualification Test (FQT): The contractor shall conduct FQT IAW the approved STP and STDs. All FQT shall be successfully completed, i.e., 100% of all tests conducted shall have passed prior to accepting the software for Government test and evaluation, prior to Developmental Test and Operational Test. The contractor shall conduct FQTs as follows:

(1) Level A: Bench level on each CSCI

(2) Level B: Bench level with either actual or emulated associated subsystem(s)

p. Stress Testing: The contractor shall conduct stress testing at both levels A and B as specified below. Stress testing shall be performed immediately

subsequent to each level FQT. Contractor-performed stress testing shall be conducted and the results reported to the Government in contractor format. Stress testing shall include the following:

(1) Functional (all levels): The software shall be tested up to and beyond its designed capacities. The contractor shall fully demonstrate the system's ability to perform within the limits of its design capacities, and demonstrate the ability to degrade safely during periods of operation beyond the design limits.

(2) Duration (level B only): The operational software shall be tested for a period of 24 continuous hours under loading conditions and other conditions representing 150% of the system's OMS/MP.

(3) Throughput

(a) CPU Loading (all levels): The contractor shall define peak operational load and demonstrate that the software shall not degrade under twice the load.

(b) Database Loading (Level A only): The contractor shall define normal database loading and demonstrate that the software shall not degrade when the data traffic is doubled.

(c) Memory RAM (Level A only): The contractor shall demonstrate that the software shall not degrade during peak CPU loading (a. above) when 50% of RAM (Random Access Memory) is made unavailable to the software program.

q. Errors During Testing: Any error during FQT shall constitute a failed test, and shall conditionally negate a successful FQT conducted at a lower level, as applicable. A regression analysis (using NBS 500-99 unit/CSC interrelationship diagrams, compiler generated cross reference listings, etc.) shall be performed as part of the corrective action process. The software shall be regression tested, as necessary. The Government must approve the regression test procedures prior to the start of test. The Government reserves the right to witness all testing. No software release will be accepted for Government use without Government approval.

(1) Unit and CSC Level: The contractor shall perform regression testing at the unit and CSC level. The contractor shall record all cases, procedures, and results in the SDFs.

(2) CSCI Level: The contractor shall perform regression testing at the CSCI level. All CSCI level functional and performance requirements that were affected by the change/addition shall be regression tested. This level of testing shall be formally demonstrated to the Government as a prerequisite for

successful completion of FQT. Results shall be documented in the applicable test report.

(3) Higher Level: If the error occurs at a level higher than the CSCI level, then the contractor shall regression test the failure up to the level at which the failure occurred.

r. Errors During Post FQT Testing: The contractor shall address all software errors occurring subsequent to FQT. Software corrective actions rectifying these shall be regression tested to level A and level B.

s. Software Test Reporting: The contractor shall document the results of each level of FQT IAW DI-MCCR-80017A and deliver the software test report IAW the associated CDRL.

t. Software Problem/Change Report: The contractor shall document all anomalies affecting software and/or documentation, regardless of source, IAW software problem/change reports (SPCRs) and deliver them to the Government IAW the associated CDRL. The contractor shall provide failure analysis and corrective action status information for all SPCRs applicable to the software. The contractor shall define a severity classification for each SPCR, strictly adhering to the classification in DOD-STD-2167A, Appendix C. Following software baselining at the start of FQT, the Government will assume final approval authority over the severity priority of each SPCR. The contractor shall maintain a current computerized SPCR database to fully record and aid in the management and tracking of SPCRs. The contractor shall submit all updates of the SPCR database in ASCII format via electronic media to the Government addressees IAW the associated CDRL.

u. Programming Language: All newly developed software shall be generated in Ada, MIL-STD-1815A. In accordance with DODD 3405.2 and DODD 3405.1, modifications to an existing CSCI which exceeds one-third of the existing code shall be considered newly developed software. Exceptions to this requirement will require a waiver approved by the Government. A DOD validated Ada compiler(s) shall be used. Use of assembly language must be fully justified and requires Government approval. If less than one-third of the lines of code are newly generated, then the language must meet DODD 3405.1 requirements.

v. Memory and Throughput Growth: Each processor in each delivered ________ (insert appropriate information) unit shall contain a 50% growth capability for both memory and throughput at the time of program acceptance by the procuring agency. Any requests for deviations or waivers from this requirement will require Government approval. The percentage of memory or processor capability available for growth will be determined by the following formula:

[1 - (used/available)] x 100

w. Training: The contractor shall prepare and present an informal training course to LCSEC personnel on the use and operation of _________ (insert appropriate information) system and software. The contractor shall describe the details of the course in the Computer Resources Integrated Support Document (CRISD) to include but not be limited to: technical data for student use and retention, lesson plans for conduct of the course, and audio-visual aids. The training shall provide as a minimum, general usage instructions, system initiation, operation, monitoring, and security aspects (if applicable).

x. Software Rights: The Government shall have unlimited rights to all operating software resident in the ____________ (insert appropriate information). The contractor shall identify any commercially available support software that has restricted rights in the CRISD. The contractor will not include any software in the system design and the Software Engineering Environment (SEE) which is proprietary.

CHECKLIST:
SOFTWARE T&E STATEMENT OF WORK

Indicate the level at which the Software T&E Issue has been addressed in the subject SOW. Assign a score between 0 (not addressed in the SOW) and 10 (very well addressed in the SOW).

	Software T&E Issue	Level of Achievement
1.	Flow-down of software T&E requirements to third-party development activities and subcontractors.	
2.	Data rights and access to software T&E data.	
3.	Relationship of software T&E to the software quality process.	
4.	Requirements for demonstration/ evaluation of software maintainability.	
5.	Interface of software T&E to configuration management and configuration control activities.	
6.	Documentation and utilization of software trouble reports (STRs) which are identified during software T&E.	
7.	Delivery of and utilization of software development documentation by software T&E activities.	
8.	Involvement of software T&E in the review and audit process.	
9.	Software T&E issues in selection of the development agent (SEE metric rating).	
10.	Requirements for software test hooks of data ports for software T&E instrumentation.	
11.	Coordinating IV&V activities with software T&E.	
12.	Reporting of correlation between software test methods and objectives of the software T&E program.	
13.	Requirements for system and software specifications to identify testable requirements.	
14.	Scheduling of levels of test to support evaluation of software maturity.	

Figure B-1. SOW Checklist

	Software T&E Issue	Level of Achievement
15.	Independent audits are conducted for each step of the software development process.	
16.	Standards are established for T&E of existing designs and code for re-use in new applications.	
17.	Standards are applied to the preparation of unit test cases.	
18.	Coding standards are used.	
19.	Statistics on software design errors are available to support T&E.	
20.	Metrics are used and applied logically and usefully.	
21.	Statistics on software code and test error are plotted over time to show trends.	
22.	Capacity requirements (CRU) are monitored for computer memory utilization.	
23.	Capacity requirements are monitored for CPU throughput and utilization.	
24.	Capacity requirements are monitored for I/O channel utilization.	
25.	Security levels and security accreditation T&E addressed in the SOW/RFP.	
26.	Test coverage is measured and recorded for each phase of software testing.	
27.	Action items resulting from reviews are coordinated with T&E program and data results.	
28.	Software Problem/Trouble Reports are prioritized, recorded and delivered to the Government.	
29.	A formal mechanism is used for controlling changes to the code.	
30.	Identification of models/simulations used for T&E purposes.	
31.	A formal mechanism is used for configuration management of the software tools used in T&E.	
32.	Test beds and/or instrumentation needs are identified or required as part of the T&E program. Validation/certification of these assets is required to use them for T&E purposes.	

0 = Not addressed 10 - Very well addressed

Figure B-1. SOW Checklist (Cont'd.)

Appendix C
Metrics Data Collection

C-1. Data Item Descriptions (DIDs)

This appendix contains draft DD Forms 1664, Data Item Descriptions, to facilitate collection of the metrics data described in this part of DA Pamphlet 73-1. The needs and resources of each program will determine the precise data submission start times and reporting frequency for each metric. See Chapter 17, Software T&E Metrics, for guidance in this area. Start times, frequency of submission, and other tailoring information are included in SOWs via DD Forms 1423, Contract Data Requirements List. It is recommended that automated means of data submission (machine readable) be employed for the majority of the data because of its potentially large volume, in some cases. It may also be desirable to combine the submission of several metrics reports if they occur with the same reporting frequency. Note: cost metric data can be obtained from cost reports submitted by means of DI-F-6000C or DI-F-6010A if the SOW or DD Form 1423 states that software elements as described in this part of DA Pamphlet 73-1 are to be included in the report. A sample cost metric DID for software elements alone is provided in this appendix for those tasks which may not be required to report via the two DIDs above.

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE

SOFTWARE COST METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to track software expenditures versus allocations over the life of the software development program.

4. APPROVAL DATE (YYMMDD)

5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)

6a. DTIC APPLICABLE

6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software cost metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION

9a. APPLICABLE FORMS

9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Cost Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Cost Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Cost metric record. For each activity type the following information shall be supplied. The format for cost metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies. No value is required for this field when reporting system/project level costs.

d. ACTIVITY_TYPE - The type of effort or product associated with the collected data. Acceptable values for CSCI level reporting are: requirements analysis, design, code and unit testing, Computer Software Component (CSC) integration and testing, formal qualification testing, and software problem change report resolution. Acceptable values for system/project level reporting are: CSCI integration and testing, software engineering management, software quality assurance, software configuration management, verification and validation, tools, new equipment and facilities, software data and project totals. Definitions for the work performed in each activity type are provided in MIL-HDBK-WBS.SW, Second Draft, dated 1 October 1991.

e. BCWS - The total number of dollars that had been budgeted for the work scheduled to be accomplished for the CSCI as of reporting period. Acceptable values are in the range 0 through 999999999.99.

f. BCWP - The total number of dollars budgeted for the work actually performed on the CSCI as of reporting period. Acceptable values are in the range 0 through 999999999.99.

g. ACWP - The total number of dollars which was actually spent for the work done on the CSCI as of this reporting period. Acceptable values are in the range 0 through 999999999.99.

TABLE I. Cost Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
ACTIVITY_TYPE	Character	15	
BCWS	Numeric 3/	12	2
BCWP	Numeric	12	2
ACWP	Numeric	12	2

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION	Form Approved OMB No. 0704-0188
2. TITLE SOFTWARE SCHEDULE METRIC DATA REPORT	1. IDENTIFICATION NUMBER DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to track key events or deliveries in the software development program.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software schedule metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Schedule Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Schedule Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Schedule metric record. For each milestone for which schedule data is required, the following information shall be supplied. The format for schedule metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. EVENT_NAME - The name of the milestone, deliverable, event or activity this record describes. Examples of events are formal system reviews, testing events, and software data product deliveries.

d. PLAN_START_DATE - The date on which the event is planned to start. The date shall be expressed as YYYY/MM/DD.

e. PLAN_END_DATE - The date on which the event is planned to be completed. The date shall be expressed as YYYY/MM/DD.

f. ACTUAL_START_DATE - The date the event actually began. The date shall be expressed as YYYY/MM/DD.

g. ACTUAL_END_DATE - The date the event actually completed. The date shall be expressed as YYYY/MM/DD.

TABLE I. Schedule Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
EVENT_NAME	Character	12	
PLAN_START_DATE	Character	10	
PLAN_END_DATE	Character	10	
ACTUAL_START_DATE	Character	10	
ACTUAL_END_DATE	Character	10	

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE	1. IDENTIFICATION NUMBER
COMPUTER RESOURCE UTILIZATION METRIC DATA REPORT	DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to track projected and measured utilization of Central Processing Units (CPUs), Input/Output channels, RAM memory and mass storage devices.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software computer resource utilization metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Computer Resource Utilization Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Computer Resource Utilization Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraphs 10.3.3 and 10.3.4. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Computer resource utilization (CRU) metric. For each target computer resource in the system information shall be supplied in accordance with the paragraphs below.

10.3.3.1 Central Processing Unit (CPU) utilization record. For each CPU in the system the following data shall be supplied. The format for CPU utilization data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CPU_ID - A unique identifier for the CPU.

d. PCNT_CPU_TGT - The target upper bound utilization value for the CPU. This is the desired maximum value for this CPU's utilization expressed as a percentage of total capacity of the CPU. Acceptable values are in the range 0 through 100.

e. PCNT_CPU_PROJ - The projected capacity utilization value for the CPU. This is the estimated percentage of maximum utilization expected at delivery. Acceptable values are in the range 0 through 100.

f. PCNT_CPU_ACT - The measured value of CPU capacity utilized during peak operational loading periods expressed as a percentage of total capacity of the CPU. Acceptable values are in the range 0 through 100.

g. COMP_TYPE - Identification as to whether measurements were taken on the actual target machine or a software test environment configuration. Acceptable values are T (target) or H (host).

10.3.3.2 Input/Output (I/O) channel utilization record. For each I/O channel in the system the following data shall be supplied. The format for I/O channel utilization data is shown in Table II.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CHAN_ID - A unique identifier for the I/O channel.

d. PCNT_CHAN_TGT - The target upper bound utilization value for the I/O channel. This is the desired maximum value for this channel's utilization expressed as a percentage of total capacity of the channel. Acceptable values are in the range 0 through 100.

e. PCNT_CHAN_PROJ - The projected capacity utilization value for the I/O channel. This is the estimated percentage of maximum utilization expected at delivery. Acceptable values are in the range 0 through 100.

f. PCNT_CHAN_ACT - The measured value of I/O channel capacity utilized during peak operational loading periods expressed as a percentage of total capacity of the channel. Acceptable values are in the range 0 through 100.

g. COMP_TYPE - Identification as to whether measurements were taken on the actual target machine or a software test environment configuration. Acceptable values are T (target) or H (host).

10.3.3.3 Random Access Memory (RAM) utilization record. For each RAM in the system the following data shall be supplied. The format for RAM utilization data is shown in Table III.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. RAM_ID - A unique identifier for the RAM device.

d. RAM_CAPACITY - The capacity of the RAM in bytes. Acceptable values are in the range 0 through 99999999999.

e. RAM_TGT - The target upper bound memory usage value, in bytes, for the RAM device. This is the desired maximum value for this RAM device's usage. Acceptable values are in the range 0 through 99999999999.

f. RAM_PROJ - The projected capacity utilization value for the RAM device. This is the estimated maximum number of bytes to be utilized at delivery. Acceptable values are in the range 0 through 99999999999.

g. RAM_ACT - The measured value of RAM utilized during peak operational loading periods, in bytes. Acceptable values are in the range 0 through 99999999999.

h. COMP_TYPE - Identification as to whether measurements were taken on the actual target machine or a software test environment configuration. Acceptable values are T (target) or H (host).

10.3.3.4. Mass storage utilization record. For each mass storage device in the system the following data shall be supplied. The format for mass storage utilization data is shown in Table IV.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. STOR_ID - A unique identifier for the mass storage device.

d. STOR_CAPACITY - The capacity of the storage in bytes. Acceptable values are in the range 0 through 99999999999.

e. STOR_TGT - The target upper bound mass storage usage value, in bytes, for the storage device. This is the desired maximum value for this device's usage. Acceptable values are in the range 0 through 99999999999.

f. STOR_PROJ - The projected capacity utilization value for the mass storage device. This is the estimated maximum number of bytes to be utilized at delivery. Acceptable values are in the range 0 through 99999999999.

g. STOR_ACT - The measured value of the storage device utilized during peak operational loading periods, in bytes. Acceptable values are in the range 0 through 99999999999.

h. COMP_TYPE - Identification as to whether measurements were taken on the actual target machine or a software test environment configuration. Acceptable values are T (target) or H (host).

10.3.4 Software memory allocation record. For each Computer Software Configuration Item (CSCI) in the system the following data shall be supplied. The format for software memory allocation data is shown in Table V.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies. .

d. CSCI_RAM_ALLOC - The RAM allocation in bytes budgeted for this CSCI in accordance with its Software Requirements Specification. Acceptable values are in the range 0 through 99999999999.

e. CSCI_RAM_USAGE - The actual amount of RAM used by the CSCI, in bytes. Acceptable values are in the range 0 through 99999999999.

f. CSCI_STOR_ALLOC - The mass storage allocation in bytes budgeted for this CSCI in accordance with its Software Requirements Specification. Acceptable values are in the range 0 through 99999999999.

g. CSCI_STOR_USAGE - The actual amount of mass storage used by the CSCI, in bytes. Acceptable values are in the range 0 through 99999999999.

h. COMP_TYPE - Identification as to whether measurements were taken on the actual target machine or a software test environment configuration. Acceptable values are T (target) or H (host).

TABLE I. Central Processing Unit Utilization Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CPU_ID	Character	12	
PCNT_CPU_TGT	Numeric 3/	3	0
PCNT_CPU_PROJ	Numeric	3	0
PCNT_CPU_ACT	Numeric	3	0
COMP_TYPE	Character	1	

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

TABLE II. Input/Output Channel Utilization Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal
DATA_DATE	Character	10	
SYSTEM_NAME	Character	20	
CHAN_ID	Character	12	
PCNT_CHAN_TGT	Numeric	3	0
PCNT_CHAN_PROJ	Numeric	3	0
PCNT_CHAN_ACT	Numeric	3	0
COMP_TYPE	Character	1	

TABLE III. Random Access Memory Utilization Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal
DATA_DATE	Character	10	
SYSTEM_NAME	Character	20	
RAM_ID	Character	12	
RAM_CAPACITY	Numeric	11	0
RAM_TGT	Numeric	11	0
RAM_PROJ	Numeric	11	0
RAM_ACT	Numeric	11	0
COMP_TYPE	Character	1	

TABLE IV. Mass Storage Utilization Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal
DATA_DATE	Character	10	
SYSTEM_NAME	Character	20	
STOR_ID	Character	12	
STOR_CAPACITY	Numeric	11	0
STOR_TGT	Numeric	11	0
STOR_PROJ	Numeric	11	0
STOR_ACT	Numeric	11	0
COMP_TYPE	Character	1	

TABLE V. Software Memory Allocation Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal
DATA_DATE	Character	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
CSCI_RAM_ALLOC	Numeric	11	0
CSCI_RAM_USAGE	Numeric	11	0
CSCI_STOR_ALLOC	Numeric	11	0
CSCI_STOR_USAGE	Numeric	11	0
COMP_TYPE	Character	1	

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188

2. TITLE

SOFTWARE ENGINEERING ENVIRONMENT METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data provides a measure of the capability of a contractor to use modern engineering techniques in the software development process.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for the software engineering environment metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Engineering Environment Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Engineering Environment Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Software Engineering Environment (SEE) metric record. For each contractor on which a software maturity level assessment is performed the following information shall be supplied. The format for software engineering environment metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. CONTRCTR_NM - The name of the contractor that was evaluated.

c. SYSTEM_NAME - Name of the system to which this data applies.

d. MAT_LEVEL - The process maturity level of the contractor. Acceptable values are in the range 1 through 5.

e. MAT_DATE - The date the process maturity level was assigned to the contractor. The date shall be expressed as YYYY/MM/DD.

TABLE I. Software Engineering Environment Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
CONTRCTR_NM	Character	15	
SYSTEM_NAME	Character	20	
MAT_LEVEL	Numeric 3/	1	0
MAT_DATE	Character	10	

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188

2. TITLE

SOFTWARE REQUIREMENTS TRACEABILITY METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to track the adherence of software products to their requirements at various developmental levels.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software requirements traceability metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Requirements Traceability Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Requirements Traceability Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraphs 10.3.3 and 10.3.4. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Software requirements traceability metric record. For each Computer Software Configuration Item (CSCI) in the system the following information shall be supplied. The format for software requirements traceability metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item name to which the data applies.

d. MILESTONE - The name of the event or activity this to which this data applies.

e. VERSION_ID - The configuration control version identification of the CSCI that is being reported.

f. NUM_SRS_REQ - The number of Software Requirements Specification (SRS) requirements for this CSCI. Acceptable values are in the range 0 through 99999.

g. NUM_SRS_REQ_NOT_UFD - The number of SRS requirements in this CSCI that are not traceable to the UFD. Acceptable values are in the range 0 through 99999.

h. NUM_UFD_SW_REQ_SRS - The number of UFD software requirements traceable to the SRS for this CSCI. Acceptable values are in the range 0 through 99999.

i. NUM_SSS_SW_REQ_SRS - The number of SSS software related requirements traceable to the SRS for this CSCI. Acceptable values are in the range 0 through 99999.

j. NUM_SRS_REQ_CSCI - The number of the CSCI's SRS requirements that are traceable to the documented design of the CSCI. Acceptable values are in the range 0 through 99999.

k. NUM_SRS_REQ_CSC - The number of the CSCI's SRS requirements traceable to the documented design of the CSCI's Computer Software Components (CSCs). Acceptable values are in the range 0 through 99999.

l. NUM_SRS_REQ_CSU - The number of the CSCI's SRS requirements traceable to the documented design of the CSCI's Computer Software Units (CSUs). Acceptable values are in the range 0 through 99999.

m. NUM_SRS_REQ_CODE - The number of the CSCI's SRS requirements traceable to the computer program code comprising the CSCI. Acceptable values are in the range 0 through 99999.

n. NUM_SRS_REQ_TSCS - The number of the CSCI's SRS requirements covered by one or more documented test case. Acceptable values are in the range 0 through 99999.

o. NUM_IRS_REQ_CSCI - The number of IRS requirements that are traceable to the documented design of the CSCI. Acceptable values are in the range 0 through 99999.

p. NUM_IRS_REQ_CSC - The number of IRS requirements traceable to the documented design of the CSCI's Computer Software Components (CSCs). Acceptable values are in the range 0 through 99999.

q. NUM_IRS_REQ_CSU - The number of IRS requirements traceable to the documented design of the CSCI's Computer Software Units (CSUs). Acceptable values are in the range 0 through 99999.

r. NUM_IRS_REQ_CODE - The number of IRS requirements traceable to the computer program code comprising the CSCI. Acceptable values are in the range 0 through 99999.

s. NUM_IRS_REQ_TSCS - The number of IRS requirements covered by one or more documented test case. Acceptable values are in the range 0 through 99999.

10.3.4 Overall requirements traceability metric record. One record of this type shall be submitted for each reporting period. The format for overall requirements traceability metric data is shown in Table II.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. MILESTONE - The name of the event or activity this to which this data applies.

d. NUM_ORD_REQ - The number of Operational Requirements Document (ORD) requirements for the system. Acceptable values are in the range 0 through 99999.

e. NUM_UFD_REQ - The number of User Functional Description (UFD) requirements for the system. Acceptable values are in the range 0 through 99999.

f. NUM_UFD_SW_REQ - The number of UFD software requirements for the system. Acceptable values are in the range 0 through 99999.

g. NUM_SSS_REQ - The number of system level specification (e.g. System/Segment Specification, SSS) requirements for the system. Acceptable values are in the range 0 through 99999.

h. NUM_SSS_SW_REQ - The number of software related requirements in the SSS for the system. Acceptable values are in the range 0 through 99999.

i. NUM_IRS_REQ - The number of software interface requirements for the system. Acceptable values are in the range 0 through 99999.

j. NUM_ORD_REQ_UFD - The number of ORD requirements which are traceable to the UFD. Acceptable values are in the range 0 through 99999.

k. NUM_UFD_REQ_ORD - The number of UFD requirements traceable to the ORD. Acceptable values are in the range 0 through 99999.

l. NUM_UFD_REQ_SSS - The number of UFD requirements traceable to the SSS. Acceptable values are in the range 0 through 99999.

m. NUM_UFD_SW_REQ_IRS - The number of UFD software requirements traceable to an IRS. Acceptable values are in the range 0 through 99999.

n. NUM_IRS_REQ_NOT_UFD - The number of IRS requirements that are not traceable to the UFD. Acceptable values are in the range 0 through 99999.

o. NUM_SSS_SW_REQ_IRS - The number of SSS software related requirements that are traceable to an IRS. Acceptable values are in the range 0 through 99999.

TABLE I. Software Requirements Traceability Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
MILESTONE	Character	12	
VERSION_ID	Character	15	
NUM_SRS_REQ	Numeric 3/	5	0
NUM_SRS_REQ_NOT_UFD	Numeric	5	0
NUM_UFD_SW_REQ_SRS	Numeric	5	0
NUM_SSS_SW_REQ_SRS	Numeric	5	0
NUM_SRS_REQ_CSCI	Numeric	5	0
NUM_SRS_REQ_CSC	Numeric	5	0
NUM_SRS_REQ_CSU	Numeric	5	0
NUM_SRS_REQ_CODE	Numeric	5	0
NUM_SRS_REQ_TSCS	Numeric	5	0
NUM_IRS_REQ_CSCI	Numeric	5	0
NUM_IRS_REQ_CSC	Numeric	5	0
NUM_IRS_REQ_CSU	Numeric	5	0
NUM_IRS_REQ_CODE	Numeric	5	0
NUM_IRS_REQ_TSCS	Numeric	5	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

TABLE II. Overall Requirements Traceability Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal
DATA_DATE	Character	10	
SYSTEM_NAME	Character	20	
MILESTONE	Character	12	
NUM_ORD_REQ	Numeric	5	0
NUM_UFD_REQ	Numeric	5	0
NUM_UFD_SW_REQ	Numeric	5	0
NUM_SSS_REQ	Numeric	5	0
NUM_SSS_SW_REQ	Numeric	5	0
NUM_IRS_REQ	Numeric	5	0
NUM_ORD_REQ_UFD	Numeric	5	0
NUM_UFD_REQ_ORD	Numeric	5	0
NUM_UFD_REQ_SSS	Numeric	5	0
NUM_UFD_SW_REQ_IRS	Numeric	5	0
NUM_IRS_REQ_NOT_UFD	Numeric	5	0
NUM_SSS_SW_REQ_IRS	Numeric	5	0

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188

2. TITLE	1. IDENTIFICATION NUMBER
SOFTWARE REQUIREMENTS STABILITY METRIC DATA REPORT	DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to indicate the degree to which changes in the software requirements affect the development effort.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software requirements stability metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Requirements Stability Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Requirements Stability Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Requirements stability metric record. For each Computer Software Configuration Item (CSCI) in the system the following information shall be supplied. The format for requirements stability metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item name to which the data applies.

d. REQ_DESCRP - The total number of software requirements discrepancies detected to date. Acceptable values are in the range 0 through 99999.

e. OPEN_STAT - The number of REQ_DESCRP discrepancies which remain open as of this reporting period. Acceptable values are in the range 0 through 99999.

f. CLOSED_STAT - The total number of REQ_DESCRP discrepancies to date which are closed as of this reporting period. Acceptable values are in the range 0 through 99999.

g. USER_ECP - The number of Engineering Change Proposals-Software (ECP-Ss) submitted in this reporting period by the user against software requirements. Acceptable values are in the range 0 through 99999.

h. USER_SLOC - The number of source lines of code affected in this reporting period by approved software requirements related ECP-Ss that were submitted by the user. Source lines of code are non-blank, non-comment, executable and data statements. Acceptable values are in the range 0 through 9999999.

i. USER_MODS_AFFECT - The number of Computer Software Units (CSUs) in the CSCI which are affected in this reporting period by approved software requirements-related ECP-Ss submitted by the user. Acceptable values are in the range 0 through 99999.

j. DEV_ECP - The number of ECP-Ss submitted in this reporting period by the developer against software requirements. Acceptable values are in the range 0 through 99999.

k. DEV_SLOC - The number of source lines of code affected in this reporting period by approved software requirements related ECP-Ss that were submitted by the developer. Source lines of code are non-blank, non-comment, executable and data statements. Acceptable values are in the range 0 through 9999999.

l. DEV_MODS_AFFECT - The number of CSUs in the CSCI which are affected in this reporting period by approved software requirements-related ECP-Ss submitted by the developer. Acceptable values are in the range 0 through 99999.

m. SLOC - The number of source lines of code in the CSCI. Source lines of code are non-blank, non-comment, executable and data statements. Acceptable values are in the range 0 through 9999999.

n. NUM_SRS_REQ - The number of Software Requirements Specification (SRS) requirements for this CSCI. Acceptable values are in the range 0 through 99999.

o. NUM_SRS_REQ_ADD - The number of SRS requirements added in this reporting period due to approved ECP-Ss. Acceptable values are in the range 0 through 99999.

p. NUM_SRS_REQ_MOD - The number of SRS requirements modified in this reporting period due to approved ECP-Ss. Acceptable values are in the range 0 through 99999.

q. NUM_SRS_REQ_DEL - The number of SRS requirements deleted in this reporting period due to approved ECP-Ss. Acceptable values are in the range 0 through 99999.

TABLE I. Requirements Stability Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
REQ_DESCRP	Numeric 3/	5	0
OPEN_STAT	Numeric	5	0
CLOSED_STAT	Numeric	5	0
USER_ECP	Numeric	5	0
USER_SLOC	Numeric	7	0
USER_MODS_AFFECT	Numeric	5	0
DEV_ECP	Numeric	5	0
DEV_SLOC	Numeric	7	0
DEV_MODS_AFFECT	Numeric	5	0
SLOC	Numeric	7	0
NUM_SRS_REQ	Numeric	5	0
NUM_SRS_REQ_ADD	Numeric	5	0
NUM_SRS_REQ_MOD	Numeric	5	0
NUM_SRS_REQ_DEL	Numeric	5	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE

SOFTWARE DESIGN STABILITY METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to provide an indication of whether the software design is approaching a stable state.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software design stability metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Design Stability Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Design Stability Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Design stability metric record. For each Computer Software Configuration Item (CSCI) in each version delivered during this reporting period the following information shall be supplied. The format for design stability metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies.

d. VERSION_ID - The configuration control version identification of the software that is being reported.

e. COMP_DATE - The date the CSCI was assigned VERSION_ID. The date shall be expressed as YYYY/MM/DD.

f. TOT_MODULES - The total number of Computer Software Units (CSUs) that are planned to comprise the final delivery of the CSCI. Acceptable values are in the range 0 through 99999.

g. TOTMOD_N_DESIGN - The total number of CSUs comprising the CSCI delivered in VERSION_ID. Acceptable values are in the range 0 through 99999.

h. FC_MOD - The total number of CSUs in which design related changes were made since the last delivery of the CSCI. Acceptable values are in the range 0 through 99999.

i. FA_MOD - The total number of CSUs that were added to the CSCI since the last delivery. Acceptable values are in the range 0 through 99999.

j. FD_MOD - The total of number CSUs that were deleted from the CSCI since the last delivery. Acceptable values are in the range 0 through 99999.

TABLE I. Design Stability Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
VERSION_ID	Character	15	
COMP_DATE	Character	10	
TOT_MODULES	Numeric 3/	5	0
TOTMOD_N_DESIGN	Numeric	5	0
FC_MOD	Numeric	5	0
FA_MOD	Numeric	5	0
FD_MOD	Numeric	5	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE	1. IDENTIFICATION NUMBER
SOFTWARE COMPLEXITY METRIC DATA REPORT	DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to provide an indication of the structure of the software and provides a means to measure, quantify and evaluate the structure of software modules.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software complexity metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Complexity Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Complexity Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Complexity metric record. For each Computer Software Unit (CSU) in the system that has been added, modified, or deleted the following information shall be supplied. The format for complexity metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies.

d. CSC_NAME - The Computer Software Component (CSC) name to which the data applies.

e. CSU_NAME - The name of the Computer Software Unit (CSU) to which the data applies.

f. DELETED - An indicator that this CSU has been deleted from the CSCI. Acceptable values are Y (deleted) or N (unit is part of the system configuration).

g. LANGUAGE - The programming language the module is written in.

h. CYCLMTIC_COMPLX - The computed value of McCabe's cyclomatic complexity for the CSU. Acceptable values are in the range 0 through 99999.

i. HALSTEAD_VOCAB - The computed value of Halstead's vocabulary term for the CSU. Acceptable values are in the range 0 through 99999.

j. HALSTEAD_PRO_LN - The computed value of Halstead's program length term for the CSU. Acceptable values are in the range 0 through 99999.

k. HALSTEAD_VOL - The computed value of Halstead's program volume term for the CSU. Acceptable values are in the range 0 through 99999.99.

l. CTRL_PATH_CROS - The total number of occurrences in the CSU where control paths cross. Acceptable values are in the range 0 through 99999.

m. SLOC - The total number of source lines of code in the CSU. Source lines of code are non-blank, non-comment, executable and data statements. Acceptable values are in the range 0 through 99999.

n. PCNT_CMNT - The computed percentage of comment lines in the CSU. Acceptable values are in the range 0 through 100.

o. PDL_OR_CODE - An indicator as to whether the complexity for this CSU was computed on its Program Design Language (PDL) or source code representation. Acceptable values are PDL or CODE.

TABLE I. Complexity Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
CSC_NAME	Character	15	
CSU_NAME	Character	15	
DELETED	Character	1	
LANGUAGE	Character	12	
CYCLMTIC_COMPLX	Numeric 3/	5	0
HALSTEAD_VOCAB	Numeric	5	0
HALSTEAD_PRO_LN	Numeric	5	0
HALSTEAD_VOL	Numeric	8	2
CTRL_PATH_CROS	Numeric	5	0
SLOC	Numeric	5	0
PCNT_CMNT	Numeric	3	0
PDL_OR_CODE	Character	4	

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE

SOFTWARE BREADTH OF TESTING METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to assess the degree to which required functionality has been successfully demonstrated as well as the amount of testing that has been performed.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software breadth of testing metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Breadth of Testing Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Breadth of Testing Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Breadth of testing metric record. For each Computer Software Configuration Item (CSCI) in the system the following information shall be supplied. The format for breadth of testing metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies.

d. NUM_SRS_REQ - The total number of SRS requirements for the CSCI under development. Acceptable values are in the range 0 through 99999.

e. TESTED_SRS_REQ - The total number of SRS requirements for the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

f. PASSED_SRS_REQ - The total number of SRS requirements for the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

g. NUM_IRS_REQ - The total number of IRS requirements associated with the CSCI under development. Acceptable values are in the range 0 through 99999.

h. TESTED_IRS_REQ - The total number of IRS requirements associated with the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

i. PASSED_IRS_REQ - The total number of IRS requirements associated with the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

j. NUM_UFD1_REQ - The total number of UFD priority level one requirements associated with the CSCI under development. Acceptable values are in the range 0 through 99999.

k. TESTED_UFD1_REQ - The total number of UFD priority level one requirements associated with the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

l. PASSED_UFD1_REQ - The total number of UFD priority level one requirements associated with the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

m. NUM_UFD2_REQ - The total number of UFD priority level two requirements associated with the CSCI under development. Acceptable values are in the range 0 through 99999.

n. TESTED_UFD2_REQ - The total number of UFD priority level two requirements associated with the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

o. PASSED_UFD2_REQ - The total number of UFD priority level two requirements associated with the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

p. NUM_UFD3_REQ - The total number of UFD priority level three requirements associated with the CSCI under development. Acceptable values are in the range 0 through 99999.

q. TESTED_UFD3_REQ - The total number of UFD priority level three requirements associated with the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

r. PASSED_UFD3_REQ - The total number of UFD priority level three requirements associated with the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

s. NUM_UFD4_REQ - The total number of UFD priority level four requirements associated with the CSCI under development. Acceptable values are in the range 0 through 99999.

t. TESTED_UFD4_REQ - The total number of UFD priority level four requirements associated with the CSCI that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

u. PASSED_UFD4_REQ - The total number of UFD priority level four requirements associated with the CSCI that have been successfully demonstrated through testing. Acceptable values are in the range 0 through 99999.

v. TEST_ID - The testing phase or test event identifier with which this data is associated. Examples of TEST_ID are FQT (Formal Qualification Test), DT (Government Developmental Test), or OT (Operational Test).

TABLE I. Breadth of Testing Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
NUM_SRS_REQ	Numeric 3/	5	0
TESTED_SRS_REQ	Numeric	5	0
PASSED_SRS_REQ	Numeric	5	0
NUM_IRS_REQ	Numeric	5	0
TESTED_IRS_REQ	Numeric	5	0
PASSED_IRS_REQ	Numeric	5	0
NUM_UFD1_REQ	Numeric	5	0
TESTED_UFD1_REQ	Numeric	5	0
PASSED_UFD1_REQ	Numeric	5	0
NUM_UFD2_REQ	Numeric	5	0
TESTED_UFD2_REQ	Numeric	5	0
PASSED_UFD2_REQ	Numeric	5	0
NUM_UFD3_REQ	Numeric	5	0
TESTED_UFD3_REQ	Numeric	5	0
PASSED_UFD3_REQ	Numeric	5	0
NUM_UFD4_REQ	Numeric	5	0
TESTED_UFD4_REQ	Numeric	5	0
PASSED_UFD4_REQ	Numeric	5	0
TEST_ID	Character	8	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE

SOFTWARE DEPTH OF TESTING METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to provide indications of the extent and success of testing from the point of view of coverage of possible paths and conditions within the software.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software depth of testing metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Depth of Testing Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subparagraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Depth of Testing Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Depth of testing metric record. For each Computer Software Unit (CSU) in the system that has been added, modified, tested, or deleted since the last reporting period the following information shall be supplied. The format for depth of testing metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies.

d. CSC_NAME - The Computer Software Component (CSC) name to which the data applies.

e. CSU_NAME - The Computer Software Unit (CSU) name to which the data applies.

f. DELETED - An indicator that this CSU has been deleted from the CSCI. Acceptable values are Y (deleted) or N (unit is part of the system configuration).

g. PATH_SUC - The total number of paths in the CSU that have been successfully executed at least once. Acceptable values are in the range 0 through 99999.

h. DECPT_SUC - The total number of decision points in the CSU that have been successfully tested at least once with all legal classes of conditions and one illegal condition. Acceptable values are in the range 0 through 99999.

i. INPUT_SUC - The total number of inputs to the CSU that have been successfully tested with one legal and one illegal entry. Acceptable values are in the range 0 through 99999.

j. STMT_SUC - The total number of statements of the CSU that have been successfully tested. Acceptable values are in the range 0 through 99999.

k. PATHS - The total number of paths in the CSU being reported. Acceptable values are in the range 0 through 99999.

l. DECPTS - The total number of decision points for the CSU being reported. Acceptable values are in the range 0 through 99999.

m. STMTS - The total number of executable statements in the CSU being reported. Acceptable values are in the range 0 through 99999.

n. INPT_INST - The total number of inputs for the CSU being reported. Acceptable values are in the range 0 through 99999.

o. TESTED_PATHS - The total number of paths in the CSU that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

p. TESTED_DECPTS - The total number of decision points in the CSU that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

q. TESTED_STMNTS - The total number of statements in the CSU that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

r. TESTED_INPT_INS - The total number of input instances to the CSU that have been tested using approved test cases. Acceptable values are in the range 0 through 99999.

TABLE I. Depth of Testing Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
CSC_NAME	Character	15	
CSU_NAME	Character	15	
DELETED	Character	1	
PATH_SUC	Numeric	5	0
DECPT_SUC	Numeric	5	0
INPT_SUC	Numeric	5	0
STMT_SUC	Numeric	5	0
PATHS	Numeric	5	0
DECPTS	Numeric	5	0
STMTS	Numeric	5	0
INPT_INST	Numeric	5	0
TESTED_PATHS	Numeric	5	0
TESTED_DECPTS	Numeric	5	0
TESTED_STMNTS	Numeric	5	0
TESTED_INPT_INS	Numeric	5	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

Page 3 of 3 Pages

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE

SOFTWARE FAULT PROFILES METRIC DATA REPORT

1. IDENTIFICATION NUMBER

DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to provide indications of the quality of the software, as well as the ability to fix known faults.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software fault profiles metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied to any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Fault Profiles Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subpragraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Fault Profiles Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Fault profiles metric record. For each Computer Software Configuration Item (CSCI) in the system the following information shall be supplied. The format for fault profiles metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. CSCI_NAME - The Computer Software Configuration Item (CSCI) name to which the data applies.

d. TOT_PR1_FLTS - The total number of priority one faults detected to date. Acceptable values are in the range 0 through 999999.

e. PR1_REQ_FLTS - The total number of priority one requirements category faults detected to date. Acceptable values are in the range 0 through 999999.

f. PR1_DESIGN_FLTS - The total number of priority one design category faults detected to date. Acceptable values are in the range 0 through 999999.

g. PR1_CODE_FLTS - The total number of priority one coding category faults detected to date. Acceptable values are in the range 0 through 999999.

h. PR1_DCMNT_FLTS - The total number of priority one documentation category faults detected to date. Acceptable values are in the range 0 through 999999.

i. PR1_OTHER_FLTS - The total number of priority one faults to date not attributable to deficiencies in requirements, design, coding or documentation categories. Acceptable values are in the range 0 through 999999.

j. TOT_PR1_CLSDFLTS - The total number of priority one faults that have been closed/resolved to date. Acceptable values are in the range 0 through 999999.

k. TOT_PR2_FLTS - The total number of priority two faults detected to date. Acceptable values are in the range 0 through 999999.

l. PR2_REQ_FLTS - The total number of priority two requirements category faults detected to date. Acceptable values are in the range 0 through 999999.

m. PR2_DESIGN_FLTS - The total number of priority two design category faults detected to date. Acceptable values are in the range 0 through 999999.

n. PR2_CODE_FLTS - The total number of priority two coding category faults detected to date. Acceptable values are in the range 0 through 999999.

o. PR2_DCMNT_FLTS - The total number of priority two documentation category faults detected to date. Acceptable values are in the range 0 through 999999.

p. PR2_OTHER_FLTS - The total number of priority two faults to date not attributable to deficiencies in requirements, design, coding or documentation categories. Acceptable values are in the range 0 through 999999.

q. TOT_PR2_CLSDFLTS - The total number of priority two faults that have been closed/resolved to date. Acceptable values are in the range 0 through 999999.

r. TOT_PR3_FLTS - The total number of priority three faults detected to date. Acceptable values are in the range 0 through 999999.

s. PR3_REQ_FLTS - The total number of priority three requirements category faults detected to date. Acceptable values are in the range 0 through 999999.

t. PR3_DESIGN_FLTS - The total number of priority three design category faults detected to date. Acceptable values are in the range 0 through 999999.

u. PR3_CODE_FLTS - The total number of priority three coding category faults detected to date. Acceptable values are in the range 0 through 999999.

v. PR3_DCMNT_FLTS - The total number of priority three documentation category faults detected to date. Acceptable values are in the range 0 through 999999.

w. PR3_OTHER_FLTS - The total number of priority three faults to date not attributable to deficiencies in requirements, design, coding or documentation categories. Acceptable values are in the range 0 through 999999.

x. TOT_PR3_CLSDFLTS - The total number of priority three faults that have been closed/resolved to date. Acceptable values are in the range 0 through 999999.

y. TOT_PR4_FLTS - The total number of priority four faults detected to date. Acceptable values are in the range 0 through 999999.

z. PR4_REQ_FLTS - The total number of priority four requirements category faults detected to date. Acceptable values are in the range 0 through 999999.

aa. PR4_DESIGN_FLTS - The total number of priority four design category faults detected to date. Acceptable values are in the range 0 through 999999.

bb. PR4_CODE_FLTS - The total number of priority four coding category faults detected to date. Acceptable values are in the range 0 through 999999.

cc. PR4_DCMNT_FLTS - The total number of priority four documentation category faults detected to date. Acceptable values are in the range 0 through 999999.

dd. PR4_OTHER_FLTS - The total number of priority four faults to date not attributable to deficiencies in requirements, design, coding or documentation categories. Acceptable values are in the range 0 through 999999.

ee. TOT_PR4_CLSDFLTS - The total number of priority four faults that have been closed/resolved to date. Acceptable values are in the range 0 through 999999.

ff. TOT_PR5_FLTS - The total number of priority five faults detected to date. Acceptable values are in the range 0 through 999999.

gg. PR5_REQ_FLTS - The total number of priority five requirements category faults detected to date. Acceptable values are in the range 0 through 999999.

hh. PR5_DESIGN_FLTS - The total number of priority five design category faults detected to date. Acceptable values are in the range 0 through 999999.

ii. PR5_CODE_FLTS - The total number of priority five coding category faults detected to date. Acceptable values are in the range 0 through 999999.

jj. PR5_DCMNT_FLTS - The total number of priority five documentation category faults detected to date. Acceptable values are in the range 0 through 999999.

kk. PR5_OTHER_FLTS - The total number of priority five faults to date not attributable to deficiencies in requirements, design, coding or documentation categories. Acceptable values are in the range 0 through 999999.

ll. TOT_PR5_CLSDFLTS - The total number of priority five faults that have been closed/resolved to date. Acceptable values are in the range 0 through 999999.

mm. AVGOPEN_AGE_PR1 - The average number of days a currently open priority one fault has remained open. Acceptable values are in the range 0 through 99999.

nn. AVGOPEN_AGE_PR2 - The average number of days a currently open priority two fault has remained open. Acceptable values are in the range 0 through 99999.

oo. AVGOPEN_AGE_PR3 - The average number of days a currently open priority three fault has remained open. Acceptable values are in the range 0 through 99999.

pp. AVGOPEN_AGE_PR4 - The average number of days a currently open priority four fault has remained open. Acceptable values are in the range 0 through 99999.

qq. AVGOPEN_AGE_PR5 - The average number of days a currently open priority five fault has remained open. Acceptable values are in the range 0 through 99999.

rr. AVGCLOSE_AGE_PR1 - The average number of days it took to close a priority one fault. Acceptable values are in the range 0 through 99999.

ss. AVGCLOSE_AGE_PR2 - The average number of days it took to close a priority two fault. Acceptable values are in the range 0 through 99999.

tt. AVGCLOSE_AGE_PR3 - The average number of days it took to close a priority three fault. Acceptable values are in the range 0 through 99999.

uu. AVGCLOSE_AGE_PR4 - The average number of days it took to close a priority four fault. Acceptable values are in the range 0 through 99999.

vv. AVGCLOSE_AGE_PR5 - The average number of days it took to close a priority five fault. Acceptable values are in the range 0 through 99999.

ww. AVG_AGE_PR1 - The average age of a priority one fault (both open and closed). Acceptable values are days in the range 0 through 99999.

xx. AVG_AGE_PR2 - The average age of a priority two fault (both open and closed). Acceptable values are days in the range 0 through 99999.

yy. AVG_AGE_PR3 - The average age of a priority three fault (both open and closed). Acceptable values are days in the range 0 through 99999.

zz. AVG_AGE_PR4 - The average age of a priority four fault (both open and closed). Acceptable values are days in the range 0 through 99999.

aaa. AVG_AGE_PR5 - The average age of a priority five fault (both open and closed). Acceptable values are days in the range 0 through 99999.

TABLE I. Fault Profiles Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
CSCI_NAME	Character	15	
TOT_PR1_FLTS	Numeric 3/	6	0
PR1_REQ_FLTS	Numeric	6	0
PR1_DESIGN_FLTS	Numeric	6	0
PR1_CODE_FLTS	Numeric	6	0
PR1_DCMNT_FLTS	Numeric	6	0
PR1_OTHER_FLTS	Numeric	6	0
TOT_PR1_CLSDFLTS	Numeric	6	0
TOT_PR2_FLTS	Numeric	6	0
PR2_REQ_FLTS	Numeric	6	0
PR2_DESIGN_FLTS	Numeric	6	0
PR2_CODE_FLTS	Numeric	6	0
PR2_DCMNT_FLTS	Numeric	6	0
PR2_OTHER_FLTS	Numeric	6	0
TOT_PR2_CLSDFLTS	Numeric	6	0
TOT_PR3_FLTS	Numeric	6	0
PR3_REQ_FLTS	Numeric	6	0
PR3_DESIGN_FLTS	Numeric	6	0
PR3_CODE_FLTS	Numeric	6	0
PR3_DCMNT_FLTS	Numeric	6	0
PR3_OTHER_FLTS	Numeric	6	0
TOT_PR3_CLSDFLTS	Numeric	6	0
TOT_PR4_FLTS	Numeric	6	0
PR4_REQ_FLTS	Numeric	6	0
PR4_DESIGN_FLTS	Numeric	6	0
PR4_CODE_FLTS	Numeric	6	0
PR4_DCMNT_FLTS	Numeric	6	0
PR4_OTHER_FLTS	Numeric	6	0
TOT_PR4_CLSDFLTS	Numeric	6	0
TOT_PR5_FLTS	Numeric	6	0
PR5_REQ_FLTS	Numeric	6	0
PR5_DESIGN_FLTS	Numeric	6	0
PR5_CODE_FLTS	Numeric	6	0
PR5_DCMNT_FLTS	Numeric	6	0
PR5_OTHER_FLTS	Numeric	6	0
TOT_PR5_CLSDFLTS	Numeric	6	0
AVGOPEN_AGE_PR1	Numeric	5	0
AVGOPEN_AGE_PR2	Numeric	5	0
AVGOPEN_AGE_PR3	Numeric	5	0
AVGOPEN_AGE_PR4	Numeric	5	0
AVGOPEN_AGE_PR5	Numeric	5	0

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Data Element Name	Data Type	Maximum Length	Decimal 1/
AVGCLOSE_AGE_PR1	Numeric	5	0
AVGCLOSE_AGE_PR2	Numeric	5	0
AVGCLOSE_AGE_PR3	Numeric	5	0
AVGCLOSE_AGE_PR4	Numeric	5	0
AVGCLOSE_AGE_PR5	Numeric	5	0
AVG_AGE_PR1	Numeric	5	0
AVG_AGE_PR2	Numeric	5	0
AVG_AGE_PR3	Numeric	5	0
AVG_AGE_PR4	Numeric	5	0
AVG_AGE_PR5	Numeric	5	0

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-).

PROPOSED DRAFT. DO NOT USE FOR ACQUISITION PURPOSES

DATA ITEM DESCRIPTION

Form Approved OMB No. 0704-0188

2. TITLE	1. IDENTIFICATION NUMBER
SOFTWARE RELIABILITY METRIC DATA REPORT	DI-XXXX-XXXXX

3. DESCRIPTION/PURPOSE

3.1 This metric data is used to indicate rates at which faults are being reduced and thus reliability increased.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC APPLICABLE	6b. GIDEP APPLICABLE

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID contains the format and content preparation instructions for software reliability metric data resulting from the work task described by AR 73-1.

7.2 This DID may be applied in any software development or maintenance contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER

10. PREPARATION INSTRUCTIONS

10.1 Reference Documents. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments, notices, and revisions shall be as specified in the contract.

10.2 Format Requirements. The Software Reliability Metric Data Report shall be comprised of introductory summary material and itemized metric data. Summary material shall be prepared on 8 1/2 by 11 inch paper or electronic media. Itemized data shall be supplied on electronic media or 8 1/2 by 11 inch paper such that it may be readily compatible with an electronic database structure. The structure for each type of data in the report is described in its corresponding Content Requirement subparagraph below.

10.2.1 Tailoring Instructions. In the event that a paragraph or subparagraph has been tailored out, a statement to that effect shall be added directly following the heading of each such (sub)paragraph.

10.2.2 Hardcopy Format. This document may be printed on one side or both sides of each page (single-sided/double-sided). All printed pages shall contain the document control number and publication date centered at the top of the page.

10.2.3 Multiple Paragraphs and Subparagraphs. Any paragraph or subparagraph in this DID starting with the phrase "this (sub)paragraph shall..." may be written as multiple paragraphs or subparagraphs to enhance readability.

(Continued on Page 2)

11. DISTRIBUTION STATEMENT

DISTRIBUTION STATEMENT A: Approved for public release, distribution is unlimited.

Block 10, PREPARATION INSTRUCTIONS (Cont'd.)

10.3 Content requirements. The Software Reliability Metric Data Report shall contain the following information:

10.3.1 Title page. This page shall contain the name and any abbreviation or acronym of the system, name of sponsoring or issuing organization, document type name, contract number, name of contractor, and publication date, as well as any necessary security markings or other restrictions on the handling of the document.

10.3.2 Summary of activity. This paragraph shall specify the start and end dates of the reporting period(s) and number of data records supplied for the data in paragraph 10.3.3. Significant or unusual circumstances affecting the preparation of the data records, if any, shall be described.

10.3.3 Reliability metric record. For each system test event for which system/software reliability data is measured the following information shall be supplied. The format for reliability metric data is shown in Table I.

a. DATA_DATE - The date associated with the values of the remaining data elements. That is, the date when this data was current. The date shall be expressed as YYYY/MM/DD.

b. SYSTEM_NAME - Name of the system to which this data applies.

c. TEST_ID - The testing phase or test event identifier with which this data is associated. Examples of TEST_ID are RGT (Reliability Growth Test), DT (Government Developmental Test) Phase I and OT (Operational Test).

d. MEASURED_FAIL_RATE - The computed failure rate of the software as measured in testing expressed in failures per month. Acceptable values are in the range 0 through 99999.99.

e. PROJECTED_FAIL_RATE - The projected failure rate of the software for the reporting period as calculated by the reliability analysis model expressed in failures per month. Acceptable values are in the range 0 through 99999.99.

f. RELY_MODEL - The name of the analytical model used to calculate the PROJECTED_FAILURE_RATE.

g. FAIL_RATE_OBJECTIVE - The desired goal of the acceptable number of software failures per month. Acceptable values are in the range 0 through 99999.99.

h. SYS_REQ_MTBF - The required/specified value of mean time between mission failures caused by system hardware or software against which the value measured during the test is compared for compliance. Acceptable values are a number of hours in the range 0 through 99999.99.

i. PEST_SYS_MTBF - The computed point estimate of mean time between mission failures caused by system hardware or software as measured during the test event (field TEST_ID). Acceptable values are a number of hours in the range 0 through 99999.99.

j. LCB_SYS_MTBF - The calculated 80% lower confidence bound value of mean time between mission failures caused by system hardware or software as measured during the test event. Acceptable values are a number of hours in the range 0 through 99999.99

k. PEST_SW_MTBF - The computed point estimate of mean time between mission failures caused by software as measured during the test event. Acceptable values are a number of hours in the range 0 through 99999.99.

l. LCB_SW_MTBF - The calculated 80% lower confidence bound value of mean time between mission failures caused by software as measured during the test event. Acceptable values are a number of hours in the range 0 through 99999.99.

m. REQ_MEAN_RESTOR - The required/specified value of mean time to restore the system to operational status. Acceptable values are a number of hours in the range 0 through 99999.99.

n. REQ_MEDN_RESTOR - The required/specified value of median time to restore the system to operational status. Acceptable values are a number of hours in the range 0 through 99999.99.

o. REQ_MAX95_RESTOR - The required/specified maximum 95th percentile value of time to restore the system to operational status. Acceptable values are a number of hours in the range 0 through 99999.99.

p. MEAN_RESTOR_SYS - The computed mean time to restore the system to operational condition. Acceptable values are a number of hours in the range 0 through 99999.99.

q. MEDN_RESTOR_SYS - The computed median time to restore the system to operational condition. Acceptable values are a number of hours in the range 0 through 99999.99.

r. MAX95_RESTOR_SYS - The computed maximum 95th percentile value of time to restore the system to operational condition. Acceptable values are a number of hours in the range 0 to 99999.99.

TABLE I. Reliability Metric Data Record Format

Data Element Name	Data Type	Maximum Length	Decimal 1/
DATA_DATE	Character 2/	10	
SYSTEM_NAME	Character	20	
TEST_ID	Character	8	
MEASURED_FAIL_RATE	Numeric 3/	8	2
PROJECTED_FAIL_RATE	Numeric	8	2
RELY_MODEL	Character	15	
FAIL_RATE_OBJECTIVE	Numeric	8	2
SYS_REQ_MTBF	Numeric	8	2
PEST_SYS_MTBF	Numeric	8	2
LCB_SYS_MTBF	Numeric	8	2
PEST_SW_MTBF	Numeric	8	2
LCB_SW_MTBF	Numeric	8	2
REQ_MEAN_RESTOR	Numeric	8	2
REQ_MEDN_RESTOR	Numeric	8	2
REQ_MAX95_RESTOR	Numeric	8	2
MEAN_RESTOR_SYS	Numeric	8	2
MEDN_RESTOR_SYS	Numeric	8	2
MAX95_RESTOR_SYS	Numeric	8	2

1/ Decimal - Number of numerals after the decimal point.
2/ Character - Alphabetic characters, numeric characters (i.e. cannot be used in mathematical calculations) or symbols.
3/ Numeric - Numerals, decimal point or negative sign (-)

Appendix D
Automated Tools and Metrics Data Collection

D-1. Introduction
This appendix documents a preliminary survey of automated tools to support collection of the specific data elements required for metrics reporting outlined in this part of DA Pamphlet 73-1 . It provides program managers and program executive officers with a listing of potential tools which can aid in the collection and reporting of software metrics.

D-2. Survey objective
a. In order for a tool to be included in this appendix the following criteria must be met to a significant degree:
(1) A sufficient number of data elements that comprise at least one metric are collected by the tool.
(2) The media options provided by the tool's output are sufficient to support the effective transfer of information to the metrics database.
b. The term "sufficient" in the case of the first criterion varies according to each metric. The media options necessary also vary in this way. The reason for so few criteria is primarily the need to provide tool support for all possible platforms and languages which may be used in systems development.

D-3. Survey methodology
a. Existing repositories of automated software tool studies were investigated for likely candidates for metrics collection. These repositories included:
(1) Software Technology Support Center (STSC).
(2) Strategic Defense Initiative Office (SDIO).
(3) Data & Analysis Center for Software (DACS).
(4) General Services Administration (GSA).
(5) National Institute of Science and Technology (NIST).
(6) Ada Information Clearinghouse (AdaIC).
b. Most of the studies above provide product overviews of tools that meet very general criteria in broad categories. Examples are requirements analysis tools and testing tools. In many cases detailed product information such as specific data inputs, output data items, and types of output media were not identified. These reports did, however, provide a list of vendors that could be contacted for additional information.
c. For each of the twelve metrics a vendor survey form was created. The survey form requested overall information such as media options for output, platforms and languages supported by the tool, and description of the tool's capabilities. The specific metric data elements of interest as identified in the data

requirements of Chapter 17, Software T&E Metrics, and Appendix D, Metrics Data Collection, of this part of DA Pamphlet 73-1 were included on the form. Once it was determined which metric(s) a particular vendor's tool was designed to collect, the appropriate survey form(s) was sent to the vendor for completion. A brief description of the Army Software Test and Evaluation Panel (STEP) effort and purpose of the survey was included. The responses to the survey forms and telephone follow-up are the basis of the products identified in this appendix.

d. A complete list of products considered in the vendor survey is supplied in paragraph D-20.

D-4. Constraints
The appendix does not represent an endorsement of a tool's capability to provide the required data elements. Although designed to ensure that the tools polled actually addressed metrics collection and reporting requirements, the initial vendor survey is not sufficient to certify that each tool listed will perform as required. The majority of the surveys were answered by the tool vendors themselves and depend upon each vendors' successful evaluation of their tool's capability in collecting and reporting the data elements listed on the survey form. It is expected upon publication of this part of DA Pamphlet 73-1 that tool vendors will request a copy of this appendix in order to satisfy real or perceived discrepancies.

D-5. Tool certification
It will be necessary to investigate whether the representation of a tool's capabilities accurately depicts its performance. This can be accomplished through a demonstration provided by the vendor using real data. Alternatively, in cases where a new release of the tool is imminent, the Army can provide the vendor with beta test support. Furthermore, a certification process can provide an opportunity to investigate other factors which could influence the selection and acquisition of a tool including: cost, usability, technical support, and additional functionality. The publication of this appendix precedes the initiation of a tool certification process.

D-6. Overall tool support for metrics
This paragraph summarizes the capabilities required of specific tools for metrics data collection and automated tool availability. Some metrics have been grouped together for discussion because they deal with similar or closely linked data requirements.

a. Cost and schedule. There are a wide range of tools one can choose from that will more than fulfill

the data requirements for the cost and schedule metric (as well as the optional manpower metric). Many of the tools can construct a work breakdown structure (WBS) defined by the user, a schedule with user defined milestones, and the integration of costs with selected WBS elements. Planned and actual costs and schedule progress are also supported for the vast majority of these tools. It is also likely that existing cost accounting systems within a developer's organization will collect the necessary data. This appendix includes some examples of tools that can capture the required data elements for cost and schedule, and also provide a number of other capabilities.

b. Computer resource utilization. Many computer systems have an accounting function that provides internal statistics on system performance and capacity management. The following represent capacity planning and system performance measurements typically available from a computer's own internal accounting system:

(1) CPU clock time. Measures the amount of time consumed by various CPU processes.

(2) Channel activity. Measures the number of requests by the CPU to transfer information to peripheral devices.

(3) Communications activity. Measures the amount of time required to transmit data.

(4) Percent CPU utilization. Records the proportion of time the CPU was active and providing resources to a user request and unavailable for use by other users.

(5) DASD storage available. The direct access storage device statistic measures the amount of auxiliary storage addressable and available to the CPU.

(6) Memory. Measures the amount of memory (main storage) addressable directly by the CPU.

(7) I/O utilization data. Measures amount of time for information transfer to and from input/output devices.

These measurements are typically expressed in terms which may require conversion before the measurements can be expressed in a format suitable for metrics reporting as defined in this part of DA Pamphlet 73-1. Additional tools, however, can provide the necessary formats for CRU metric expression. These tools are designed and developed for the performance measurement of a very specific series of computer systems. These products reduce the time and effort required to manage current and future system performance. They provide expansive functionality and an easy user interface to a wide range of sophisticated features. Difficulties in measuring system performance arise when one attempts to accommodate a variety of multiprocessor architectures. The configurations can range from highly parallel structures, where processing elements are tightly

coupled and used to solve only one problem at a time, to loosely coupled systems where each processor is working on a different problem. Many of the previously listed measurements for single processors can accommodate a multiprocessor environment if the number of active processors can be included in the equations and the difference in processor capabilities can be accounted for in order to provide a common baseline of analysis. Performance management tools can also provide support for these multiprocessor environments.

c. Software Engineering Environment (SEE). It is questionable whether automating the forms that comprise the Software Engineering Institute's (SEI) capability assessment will enhance the collection process of the SEE metric. An assessment of an organization's software development process requires an in-depth investigation of policies and practices; automating even a portion of the assessment process could compromise the high level of human interaction necessary to successfully conduct an assessment. The SEI has not developed an automated version of the assessment process and no publicly available tool exists. Some vendors have developed automated forms for a developer's own use in assessing an organization's capability, but these are not intended to replace the actual assessment process. At present the only data required for the SEE metric from the actual assessment process are the overall maturity level of the developer's organization and the date the maturity level was assigned. The collection of these data do not require automated support.

d. Requirements traceability. Automatic calculation of forward and backward tracing between requirements documents, design and code would be ideal for the automated support of this metric. Unfortunately, many of the tools capable of requirements traceability are dependent upon one or more specific methodologies for requirements analysis and design. These methodologies are expressed through formal notation such as data flow diagrams or entity relationship diagrams. It is typically these notations that are used by the tools to successfully conduct a trace of requirements from the development of the requirements to the development of test cases. The requirements traceability metric calls for documented requirements meaning that in order for an automated tool to capture and trace requirements through the life cycle requires the identification and parsing of requirements statements from text. Increasingly, vendors are developing CASE tools which address the entire software life cycle. The requirements traceability metric requires the kind of support that, at least for the present, only a CASE tool can provide. Very few of these tools have been developed in support

of the stringent, text-based, tracing requirements of a system developed for the Department of Defense.

e. Requirements stability, design stability and breadth of testing. These metrics are not as data intensive as the complexity and depth of testing metrics and do not necessarily require automated support. Two categories of tools provide some type of support for these metrics.

(1) One of the benefits of finding a tool that supports requirements traceability is that it will typically support the other metrics that directly concern changes in the requirements and design of the product over the entire life cycle. The two stability metrics deal with these changes. The unique data elements that comprise the breadth of testing metric merely comprise an accumulated total of requirements drawn from the requirements traceability metric that have been tested (and either passed or failed) and those successfully tested. Therefore, a tool that can collect the data elements that comprise the requirements traceability metric is also likely to capture (or can be adapted to capture) the data elements that comprise the breadth of testing metric as well.

(2) Configuration management tools may address design stability and some fault tracking systems will indirectly collect data for requirements stability; but requirements stability, design stability and breadth of testing do not have tools specifically designed for collection and reporting of the data elements described in this part of DA Pamphlet 73-1. Configuration management tools do not provide the kind of output necessary to support an effective transfer of data to a metrics database.

f. Complexity and depth of testing. Automated support for the data elements comprising the complexity depth of testing metrics is necessary due to the computational nature and data volume associated with these metrics. Many commercial vendors have developed tools that calculate the Halstead metrics and McCabe's cyclomatic complexity. Some compilers also compute complexity, but they are not included in this analysis. Tools that collect instances of control flow crossings within a CSU are much less common. Commercial vendors supply automated tools that support many of the data elements comprising the depth of testing metric under the label of coverage analysis. While there are many tools which collect some aspect of complexity and coverage analysis, there are few tools which collect all the data elements required for either metric and even fewer that collect all the data elements required for both. There is a trend towards the development of "tool suites" which, if used as a complete package, will provide many of the data elements required for

complexity and depth of testing. One example of this interdependent combination is offered by tools which provide the user with an ability to create test cases from requirements "automatically"; however, to collect information regarding the number of inputs successfully tested and inputs with successful test cases will require the use of another tool normally referred to as a test execution tool. This interdependence between tools that are part of a product suite can make data collection for metrics more difficult and costly. Ideally the tool selected will be designed specifically for coverage and/or complexity analysis.

g. Fault profiles. Developer's typically have a problem reporting system in place whether it is a manual paper system or an automated one. These systems provide a mechanism for an organization to gather software quality measures throughout the software life cycle. These systems can usually support the data requirements of the fault profiles metric. Depending upon the flexibility of the system in place, it is possible the problem reporting system can be adapted to include any missing data collection requirements of the fault profiles metric that are not already in place. If an adaptable problem reporting system is not already in place it may be necessary to acquire a commercial system for collecting and reporting software problem reports. Very few commercial tracking systems exist because many large organizations develop their own software trouble reporting systems that are linked to their own development process. The commercial systems have to be developed independent of any methodology in order to command a reasonable market. The vendors of the fault profiles tools listed in this appendix maintain that their product is process independent and that they collect and report most if not all the data elements required.

h. Reliability. A number of software reliability models exist, each having its own associated assumptions, limitations, and applicability. Many of these models attempt to represent the uncertainty associated with software performance using probability theory. Statistical methods, such as confidence intervals, are used to make inferences about the software's performance. Adopting a particular model that is based on probability theory also means accepting the particular pattern or distribution of software failures employed by that particular model. At this time no consensus exists regarding the distribution of software failures within a system and for that reason this appendix does not endorse the use of any particular model to supplement the collection and reporting of the reliability metric. The data elements of the reliability metric provide some of the inputs to these models. The data elements themselves

are obtained through the collection of observed software and system failures experienced during testing. The candidate reliability tool listed in this report, the Statistical Modeling and Estimation of Reliability Function for Software (SMERFS) program, can automatically calculate some of the data elements used to support this metric as well as providing access to many reliability models. This flexibility encourages users to exercise a wide variety of reliability models, without endorsing a particular model, in order to determine which provides the closest representation of the actual distribution of a system's software failure rate.

D-7. Cost tools
The following products support collection of cost metric data. Those data elements subject to automation are marked with an "X" in Table D-1.

a. Artemis I/CSCS
b. CA-SuperProject
c. Lotus 1-2-3 @Project Resources
d. Micro Planner X-Pert 2.0
e. Multitrak
f. Primavera 5.0
g. Project Scheduler 5
h. Tracker/3000
i. Ultra Planner
j. Viewpoint

D-8. Schedule tools
The following products support collection of schedule metric data. Those data elements subject to automation are marked with an "X" in Table D-2.

a. Artemis I/CSCS
b. CA-SuperProject
c. Lotus 1-2-3 @Project Resources
d. Micro Planner X-Pert 2.0
e. Multitrak
f. Primavera 5.0
g. Project Scheduler 5
h. Tracker/3000
i. Ultra Planner
j. Viewpoint

D-9. Computer resource utilization tools
The following products support collection of computer resource utilization metric data. Those data elements subject to automation are marked with an "X" in Table D-3.

a. DECps: Data Collector, Performance Advisor, Capacity Planner, and Accounting Chargeback
b. Laser RX/UX Performance for HP 9000 Systems
c. HP GlancePlus UX Software for HP 9000 Systems

Table D-1. Candidate Cost Metric Tools

	Artemis I/CSCS	CA-SuperProject	Lotus 1-2-3 @Project Res.	Micro Planner X-Pert 2.0	Multitrak	Primavera 5.0	Project Scheduler 5	Tracker/3000	Ultra Planner	Viewpoint
BCWS - Total # of dollars that had been budgeted for the work scheduled to be accomplished for the identified activity	X	X	X	X	X	X	X	X	X	X
BCWP - Total # of dollars budgeted for the work actually performed for the identified activity	X	X	X	X	X	X	X	X	X	X
ACWP - Total # of dollars actually spent for the work done on the identified activity	X	X	X	X	X	X	X	X	X	X

D-10. Software engineering environment tools
As discussed in paragraph D-6, automated tools for collecting or reporting SEE metric data are not feasible.

D-11. Requirements traceability tools
The following products support collection of requirements traceability metric data. Those data elements subject to automation are marked with an "X" in Table D-4.

a. CHECKPOINT
b. RTM
c. RTrace

D-12. Requirements stability tools
The following products support collection of requirements stability metric data. Those data elements subject to automation are marked with an "X" in Table D-5.

a. CHECKPOINT
b. RTM
c. RTrace

Table D-2. Candidate Schedule Metric Tools

	Artemis I/CSCS	CA-SuperProject	Lotus 1-2-3 @Project Res.	Micro Planner X-Pert 2.0	Multitrak	Primavera 5.0	Project Scheduler 5	Tracker/3000	Ultra Planner	Viewpoint
Name of the event, activity or milestone	X	X	X	X	X	X	X	X	X	X
Date on which event is planned to start	X	X	X	X	X	X	X	X	X	X
Date on which event is planned to complete	X	X	X	X	X	X	X	X	X	X
Date on which event actually began	X	X	X	X	X	X	X	X	X	X
Date on which event actually completed	X	X	X	X	X	X	X	X	X	X

Table D-3. Candidate Computer Resource Utilization Metric Tools

	DECps: Data Collector, Performance ...	Laser RX/UX Performance for HP 9000 Systems	HP GlancePlus UX Software for HP 9000 Systems
For each CPU, measured value of CPU capacity utilized during peak operational loading periods expressed as % of the CPU's total capacity	X	X	X
For each I/O channel, measured value of I/O channel capacity utilized during peak operational loading periods expressed as % of total capacity of the channel	X	X[1]	X[1]
For each RAM, measured value of RAM utilized during peak operational loading periods, in bytes	X	X	X
For each storage device, measured value of the storage device utilized during peak operational loading periods, in bytes	X	X	X
Actual amount of RAM used by CSCI, in bytes	X	X	X
Actual amount of mass storage used by CSCI, in bytes	X	X	X

[1] Calculated in terms of disk I/O activity; convert by calculating I/O rate for each drive and linking to corresponding channel.

Table D-4. Candidate Requirements Traceability Metric Tools

	CHECKPOINT	RTM	RTrace
# of Software Reqt Specifications (SRS) per CSCI	X	X	X
# of SRS not traceable to User Functional Description (UFD) per CSCI		X	X
# of UFD software reqts traceable to SRS per CSCI		X	X
# of SSS (system level specification) reqts traceable to SRS per CSCI *			
# of CSCI's SRS reqts that are traceable to the documented design of the CSCI		X	X
# of CSCI's SRS reqts that are traceable to the documented design of the CSCI's CSCs		X	X
# of CSCI's SRS reqts that are traceable to the documented design of the CSCI's CSUs		X	X
# of CSCI's SRS reqts that are traceable to the computer program code comprising the CSCI		X[1]	
# of CSCI's reqts from the SRS covered by one or more documented test case		X	X
# of CSCI's IRS reqts that are traceable to the documented design of the CSCI *			
# of CSCI's IRS reqts that are traceable to the documented design of the CSCI's CSCs *			
# of CSCI's IRS reqts that are traceable to the documented design of the CSCI's CSUs *			
# of CSCI's IRS reqts that are traceable to the computer program code comprising the CSCI *			
# of CSCI's reqts from IRS(s) covered by one or more documented test case *			
# of Operational Requirements Document (ORD) reqts for the entire system	X	X	X
# of UFD reqts for the entire system *			
# of UFD software requirements for the entire system	X	X	X
# of SSS reqts for the system *			
# of SSS software reqts for the system *			
# of software interface reqts for the system *			
# of ORD reqts traceable to the UFD		X	X
# of UFD reqts traceable to the ORD		X	X
# of UFD reqts traceable to the SSS *			
# of UFD reqts traceable to IRS(s) *			
# of IRS reqts that are not traceable to the UFD *			
# of SSS software reqts traceable to IRS(s) *			

* Data element added after vendor survey data received. It is unknown whether the product does or does not support collection of this element.

[1] Completed by RTM pointing to code module.

Table D-5. Candidate Requirements Stability Metric Tools

	CHECKPOINT	RTM	RTrace
# Software Reqt Discrepancies (SRD) detected to date	X	X	X
# of SRDs which remain open to date	X	X	X
# of SRDs which are closed to date	X	X	X
# of ECP-S[1] submitted by user against software reqts	X	X	X
# of SLOC[2] affected by approved software reqts related ECP-Ss submitted by the user	X	X[3]	
# of CSUs in the CSCI which are affected in this reporting period by approved software requirements-related ECP-Ss submitted by the user			
# of ECP-Ss submitted by the developer against software reqts	X	X[3]	X
# of SLOC affected by approved software reqts related ECP-Ss submitted by the developer	X	X[3]	
# of CSUs in the CSCI which are affected in this reporting period by approved software requirements-related ECP-Ss submitted by the developer			
# of SLOC in the CSCI	X	X[3]	

1 Engineering Change Proposal-Software
2 Source Line of Code - are non-blank, non-comment, executable and data statements.
3 Completed by RTM object containing SLOC attribute per code module.

D-13. Design stability tools

The following products support collection of design stability metric data. Those data elements subject to automation are marked with an "X" in Table D-6.

a. CHECKPOINT
b. RTM
c. RTrace

D-14. Complexity tools

The following products support collection of complexity metric data. Those data elements subject to automation are marked with an "X" in Table D-7.

a. AdaMat
b. AdaQuest
c. Analysis of Complexity (ACT)
d. CMS-2 Source Code Metrics Generator
e. CodeMap
f. C-Metric
g. HINDSIGHT

Table D-6. Candidate Design Stability Metric Tools

	CHECKPOINT	RTM	RTrace
# of CSUs that are planned to comprise the final delivery of the CSCI	X	X	X
# of CSUs comprising the CSCI delivered the present software version	X	X	X
# of CSUs in which design related changes were made since the last delivery of the CSCI	X	X	X
# of CSUs that were added to the CSCI with since the last delivery	X	X	X
# of CSUs that were deleted from the CSCI since the last delivery	X	X	

h. Logiscope
i. PC Metric
j. QA FORTRAN and QA C
k. TESTBED
l. VIA/SmartDoc

D-15. Breadth of testing tools
The following products support collection of breadth of testing metric data. Those data elements subject to automation are marked with an "X" in Table D-8.

a. CHECKPOINT
b. RTM
c. RTrace

D-16. Depth of testing tools
The following products support collection of depth of testing metric data. Those data elements subject to automation are marked with an "X" in Table D-9.

a. AdaRAID
b. AdaTune
c. Analysis of Complexity (ACT)
d. Autoflow C
e. CMS-2 Test Coverage Analyzer
f. CodeMap
g. C-Metric
h. J73AVS and RXVP80
i. Logiscope
j. QA FORTRAN and QA C
k. TCAT and TCAT-PATH
l. TESTBED

Table D-7. Candidate Complexity Metric Tools

	AdaMat	AdaQuest	Analysis of Complexity (ACT)	CMS-2 Source Code Metrics	CodeMap	C-Metric	HINDSIGHT	Logiscope	PC Metric	QA FORTRAN and QA C	TESTBED	VIA/SmartDoc
McCabe's cyclomatic complexity computed per CSU	X	X	X	X	X	X	X	X	X	X	X	X
Halstead vocabulary computed per CSU		X	[1]	X				X	X	X	X	
Halstead program length term computed per CSU		X	[1]	X				X	X	X	X	
Halstead program volume computed per CSU		X	[1]					X	X	X	X	X
Instances of control paths crossing per CSU							X	X		X	X	X
Source lines of code per CSU	X	X	X	X		X	X	X	X	X	X	
Percent of comment lines per CSU	X	X	X	X		X	X	X	X	X	X	

[1] Will include these metrics in updated version due in June 1992.

D-17. Fault profiles tools

The following products support collection of fault profiles metric data. Those data elements subject to automation are marked with an "X" in Table D-10.

a. CHECKPOINT
b. DDTs: Distributed Defect Tracking
c. MIL/SOFTQUAL

D-18. Reliability tools

The following product supports collection of reliability metric data. Those data elements subject to automation are marked with an "X" in Table D-11.

a. SMERFS

Table D-8. Candidate Breadth of Testing Metric Tools

	CHECKPOINT	RTM	RTrace
# of Software Requirements Specification (SRS) documented requirements for the Computer Software Configuration Item (CSCI) under development	X	X	X
# of SRS reqts for the CSCI that have been tested using approved test cases	X	X	X
# of SRS reqts for the CSCI that have been successfully demonstrated through testing	X	X	X
# of Interface Requirements Specification (IRS) reqts associated with the CSCI under development *			
# of IRS reqts for the CSCI that have been tested using approved test cases *			
# IRS reqts for the CSCI that have been successfully demonstrated through testing *			
# of Users' Functional Description priority level 1 (UFD1) reqts associated with the CSCI under development *			
# of UFD1 reqts for the CSCI that have been tested using approved test cases *			
# of UFD1 reqts for the CSCI that have been successfully demonstrated through testing *			
# of UFD priority level 2 - 4 (UFD2-4) reqts associated with the CSCI under development (Separate record for each priority level) *			
# of UFD2-4 reqts for the CSCI that have been tested using approved test cases *			
# of UFD2-4 reqts for the CSCI that have been successfully demonstrated through testing *			
Testing phase or test event identifier with which the preceding data elements are associated	X	X	X

* Data element added after vendor survey data received. It is unknown whether the product does or does not support collection of this element.

D-19. Product information

Descriptions of the tools identified in the previous paragraphs are presented in alphabetical order by product name. The first time the product name appears it is shown in bold type in order to facilitate lookup of specific products.

Table D-9. Candidate Depth of Testing Metric Tools

	AdaRAID	AdaTune	Analysis of Complexity	Autoflow C	CMS-2 Test Coverage	CodeMap	C-Metric	J73AVS and RXVP80	Logiscope	QA FORTRAN and QA C	TCAT and TCAT-PATH	TESTBED
Total # CSU paths successfully executed at least once	X		X	X	X	X		X	X		X	X
Total # CSU decision points executed at least once with all legal and one illegal classes of conditions	X	X	X			X[1]			X		X	X
Total # CSU inputs successfully tested with one legal and one illegal entry			X			X[1]						X
Total # of statements of CSU successfully tested	X		X			X		X	X		X	X
Total # of CSU paths			X	X	X	X	X	X	X	X	X	X
Total # of statements						X	X	X	X	X	X	X
Total # of CSU decision points (DP)		X	X			X			X	X	X	X
Total # of CSU inputs						X						X
Total # of tested CSU paths with approved test cases			X	X	X	X[1]		X			X	X
Total # of tested CSU DP with approved test cases		X	X			X[1]					X	X
Total # of tested CSU statements with approved test cases			X			X[1]		X			X	X
Total # of Tested CSU Inputs with approved test cases						X[1]						X

1 For calculation requires use of test cases and test verification together.

Table D-10. Candidate Fault Profiles Metric Tools

	CHECKPOINT	DDTs	MIL/SOFTQUAL
Total priority 1 faults (all records per CSCI)	X	X	X
Priority 1 faults due to requirements activity	X	X	X
Priority 1 faults due to design activity	X	X	X
Priority 1 faults due to coding activity	X	X	X
Priority 1 faults due to documentation activity	X	X	X
Priority 1 faults due to other activity	X	X	X
Total priority 1 faults closed	X	X	X
Total priority 2 - 5 faults (Record for each priority)	X	X	X
Priority 2 - 5 faults due to requirements activity	X	X	X
Priority 2 - 5 faults due to design, coding, document and other activities. (Separate record for each priority class w/in each activity)	X	X	X
Total priority 2 - 5 faults closed (Record for each priority classification)	X	X	X
Average # of days priority 1 faults remained open		X	X
Average # of days priority 2 - 5 faults remained open (Record for each priority classification)		X	X
Average # of days it took to close a priority 1 fault		X	
Average # of days it took to close a priority 2 - 5 fault (Record for each priority classification)		X	
Average age of priority 1 faults (open and closed)		X	X
Average age of priority 2 - 5 faults (open and closed)		X	X

a. Tool. **AdaMAT**

(1) Metric(s) supported. Complexity.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in DOS Text file.

(4) Platform(s)/language(s) supported. Ada / DEC VAX/VMS, SUN-3, SUN-4, Rational, SCO UNIX.

(5) Vendor address/telephone.

Dynamics Research Corporation
60 Frontage Road
Andover, MA 01810 USA
1(800) 522-7321

Table D-11. Candidate Reliability Metric Tools

	SMERFS
Measured software failure rate, in failures per month	X
Projected software failure rate, in failures per month	X
Computed point estimate of mean time between mission failures caused by system hardware or software as measured during the test event	
Calculated 80% lower confidence bound value of mean time between mission failures caused by system hardware or software as measured during the test event	
Computed point estimate of mean time between mission failures caused by software as measured during the test event	
Calculated 80% lower confidence bound value of mean time between mission failures caused by software as measured during the test event	
Mean time to restore the system to operational condition in hours	
Median time to restore the system to operational condition in hours	
Maximum 95th percentile value of time to restore the system to operational condition	

(6) Vendor supplied information. AdaMAT is a comprehensive static source code analyzer that reports on hundreds of Ada-specific quality metrics. The metrics focus on the most effective use of the Ada language and adherence to long-standing software quality engineering principles. AdaMAT analyzes Ada source code and the measurements are output into detailed reports that provide visibility into the quality of the code. High-level parameters measure such areas as reliability, portability, and maintainability. While other metrics address specific programming concerns, such as code simplicity, modularity, self-descriptiveness, exactness, clarity, and independence. Output can also be displayed in graphic format on an IBM PC or compatible, via AdaMAT's Metrics Display Tool.

b. Tool. **AdaQuest**

(1) Metric(s) supported. Complexity.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output provided in ASCII file.

(4) Platform(s)/language(s) supported. Ada / DEC VAX/VMS, ULTRIX (Capability due in 4th Quarter FY 1992).

(5) Vendor address/telephone.
General Research Corporation
5383 Hollister Ave
Santa Barbara, CA 93460 USA
(805) 964-7724

(6) Vendor supplied information. AdaQuest is a computer-aided software engineering (CASE) tool set supporting Ada software tests and analysis during the coding, testing and maintenance phases of the software life cycle. Through a combination of static and dynamic analysis, AdaQuest locates potential errors, measures test thoroughness, and assists reverse-engineering of Ada programs. Static Analysis examines the structural, symbol usage and control flow characteristics of a program, and produces a variety of reports from this information. It also checks for violations of 29 user-tailored programming standards. Dynamic Analysis instruments the source code of a program to measure execution coverage and timing behavior, and also checks for run-time violations of logical assertions, which are embedded (as Ada comments) into the source code by the programmer. A post-mortem processor then analyzes the collected data and presents it as tabular, histogram and source listing formats.

c. Tool. **AdaRAID**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output format for electronic media unknown.

(4) Platform(s)/language(s) supported. DEC VAX/VMS / Ada, JOVIAL.

(5) Vendor address/telephone.
PSS Inc.
429 Santa Monica Blvd., Suite 430
Santa Monica, CA 90401
(310) 394-5233

(6) Vendor supplied information. AdaRAID is available in two versions: a multi-processor simulator version and a hardware version. AdaRAID can debug programs for any Ada or JOVIAL compiler that provides debug information in either IEEE 695 or PSS Standard or Blocked format. Users can view source and monitor results, registers and memory via conditional breakpoints and watchpoints; as well as with step, go and stop buttons; time programs; trace programs all in source or assembly form.

d. Tool. **AdaTune**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports.

(4) Platform(s)/language(s) supported. MS-DOS 386 (32 BIT) SUN-3, Apollo and HP 9000/300 / Ada.

(5) Vendor address/telephone.

Alsys
67 South Bedford St.
Burlington, MA 01803-5152
(617)270-0030

(6) Vendor supplied information. AdaTune is a unique software engineering tool that performs both performance analysis and coverage analysis of Ada programs. AdaTune gives you greater understanding of your applications behavior. AdaTune gives you quantitative information that you can use to fine-tune your application performance and improve its reliability.

e. Tool. **Analysis of Complexity (ACT)**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported. SUNSparc, SUN, IBM RS/6000, DEC VMS, DEC RISC, Apollo, HP, Silicon Graphics, IBM PC and Compatibles / C, COBOL, PDL 81, OS PL/1, VAX FORTRAN, PASCAL, Ada, CMS-2, BLISS (DEC), C++.

(5) Vendor address/telephone.

McCabe & Associates, Inc.
5501 Twin Knolls Road, Suite 111
Columbia, MD 21045 USA
(301) 596-3080

(6) Vendor supplied information. ACT provides visual representations of code that make identifying complex code easy. ACT generates a complete set of test paths and end-to-end test conditions that ensure 100% basis path coverage. ACT increases productivity by avoiding redundant tests and reducing the costly time it takes to create test paths by hand. With ACT, unit testing can take 1/100 of the time it takes using ad hoc or conventional methods. ACT computes the McCabe Cyclomatic Complexity Metric for each module; application of this metric saves a project as much as 50% in testing costs.

f. Tool. **Artemis I/CSCS**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(a) PC and Vax versions and the newly announced Unix version, I/CSCS is also available for mainframe computers.

(b) Artemis I/CSCS Mini 2.6 is now available on Unix platforms, including the Hewlett-Packard HP9000 and Sun SPARCstation.

(5) Vendor address/telephone.

Lucas Management Systems
12701 Fair Lakes Circle
Suite 350
Fairfax, Va, 22033
(703) 222-1111
FAX (703) 222-8203

(6) Vendor supplied information. I/CSCS (Integrated Cost Schedule Control System) is meant to help control costs in any business or project. It helps managers estimate, organize, plan, and analyze project performance from proposal through delivery. The software complies with the DODI 5000.2 management reporting system standard specified in some federal contracts. The newest personal computer version of the package works with Microsoft Windows 3.0, taking advantage of Windows' graphical user interface, extended memory, cut-and-paste among applications, and the ability to query databases from within an application using the SQL (structured query language) standard. I/CSCS PC 2.0 also includes Artemis Presents!, a Postscript graphics tool designed to help users combine charts and reports. It works with Ethernet networks and distributed databases, and the newest version offers a choice of support for the Oracle or Ingres database software.

g. Tool. **Autoflow C**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file, Postscript, HPGL Plotter, IEW/ADW import file, Lotus PIC file.

(4) Platform(s)/language(s) supported. MS-DOS, OS/2, UNIX: C.

(5) Vendor address/telephone.

AutoCase Technology
10133 S Portal Ave.
Cupertino, CA 95014
(408) 446-2273

(6) Vendor supplied information. Generates flow charts and structure charts automatically from existing C code. It also performs automatic test coverage analysis. It takes the hassle out of trying to decipher someone else's logic in a program. It also saves time when it comes to making your project documentation complete. No limit on source program size.

h. Tool. **CA-SuperProject**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(a) Windows, MS-DOS, IBM mainframes, Unix, Apple MacIntoshes and VAX/VMS.

(5) Vendor address/telephone.

Computer Associates
12120 Sunset Hills
Reston, VA 22091
(800) 874-9392

(6) Vendor supplied information.

CA-SuperProject is a project management program that is rich in functionality and highly professional. The product, first introduced in 1984, currently holds two-fifths of the market for project management software. CA-SuperProject handles resource management effectively, even for multiple projects. The default layout is a Task Outline, which has a spreadsheet interface and includes a Gantt chart. The alternatives are a PERT chart and a Work Breakdown Structure chart. A cost/resource histogram can also be displayed in a panel. With each type of chart, you can define the task dependencies and durations, either with the mouse or via a forms interface. The Accounts Outline focuses on the costs of the project and lets you group the various tasks by account code. If you set up your codes to reflect different types of resource, the accounts outline shows how much you're spending, for instance, on wages to contract staff, part-timers, or full-time employees, and how much on equipment hire. Data can be imported and exported in a variety of formats, including Lotus 1-2-3, dBase III, Microsoft Excel, SuperCalc, SYLK, Fixed ASCII and Comma Separated Values (CSV) as well as two other project management programs, Abtex's PertMaster Advance and Hoskyn's Project Manager Workbench.

i. Tool. **CHECKPOINT**

(1) Metric(s) supported. Requirements traceability, requirements stability, design stability, breadth of testing, fault profiles.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. Application supports all platforms and over 300 languages. It operates under MS DOS and will be available in UNIX in the near future.

(5) Vendor address/telephone.
SPR Inc.
77 South Bedford St.
Burlington, MA 01803-5154
(617) 273-0140

(6) Vendor supplied information. CHECKPOINT is a powerful knowledge-based tool that provides guidance and support for software managers and information systems executives seeking to improve the quality of their products, shorten delivery times and lower both development and maintenance costs by increasing productivity. CHECKPOINT automates and integrates support for three critical management skills in one package: comprehensive measurement, dependable estimation for project planning, and expert assessment for tradeoff strategies.

j. Tool. **CMS-2 Source Code Metrics Generator**

(1) Metric(s) supported. Complexity

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output provided in text files.

(4) Platform(s)/language(s) supported. CMS-2 / VAX/VMS, MS-DOS.

(5) Government address/telephone.
Fleet Combat Direction Systems Support Activity
San Diego, CA
(703) 671-1475

(6) Government supplied information. The tool operates independently of any programming standards and/or conventions. In processing raw CMS-2 the tool develops metric and statistic reports including calltree hierarchy report, keyword frequency report, source code statistics report, list data units by type and alphabetize data units.

k. Tool. **CMS-2 Test Coverage Analyzer**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output provided in text file.

(4) Platform(s)/language(s) supported.

(a) VAX/VMS, MS-DOS / CMS-2.

(5) Government address/telephone.
Fleet Combat Direction Systems Support Activity
San Diego, CA
(703) 671-1475

(6) Government supplied information. The tool performs flow analysis of the source code, inserting instrumentation code at the respective branch points. Execution of the instrumented code during unit and/or integration test causes development of a database from which reports are generated identifying the percentage of branch points exercised, the specific exercised

branch points, and repetition counts for specific branch points.

l. Tool. **CodeMap**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output provided in ASCII file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. Platform(s) unknown / Ada, C.

(5) Vendor address/telephone.

Cadre Technologies
2111 Wilson Blvd.
Suite 700
Arlington, VA 22201
(703) 875-8670

(6) Vendor supplied information. (No information provided).

m. Tool. **C-Metric**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output format for electronic media unknown.

(4) Platform(s)/language(s) supported. DOS, OS/2 / C, C++.

(5) Vendor address/telephone.

Software Blacksmiths
6064 St. Ives Way
Mississauga, Ontario
Canada, L5N 4M1
(416) 858-4466

(6) Vendor supplied information. C-Metric calculates path complexity and counts code, statements, and comments.

n. Tool. **DDTs: Distributed Defect Tracking**

(1) Metric(s) supported. Fault profiles.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Output flat file format for electronic media.

(4) Platform(s)/language(s) supported. SUN-3, SUN-4, HP-9000, RS-6000, SCO UNIX, DECstation or VAXstation running Ultrix, Apollo running the vendor supplied UNIX.

(5) Vendor address/telephone.

QualTrak
1250 Oakmead Parkway, Suite 210
Sunnyvale, CA 94088-35994
(617) 273-0140

(6) Vendor supplied information. DDTs keeps defects organized and separated into projects. Each

defect record keeps all available information regarding the bug in one neat package, including the current status of the defect, the data files needed to reproduce the problem, text files of any length to explain the problem, or workarounds from the lab engineer. The distributed operation of DDTs is vital if code developers are in different locations or are implementing on different machines. DDTs supports software development conforming to DOD-STD-2167A and the IEEE P1044 draft proposed defect tracking system standard.

o. Tool. **DECps: Data Collector, Performance Advisor, Capacity Planner, and Accounting Chargeback**

(1) Metric(s) supported. Computer resource utilization.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Textual and Graphic output. Provides output in ASCII or DOS text file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. DEC VAX/VMS.

(5) Vendor address/telephone.

Digital Electronics Corp.
PO Box 2008
Nashua NH 03061-2008
1(800) 344-4825

(6) Vendor supplied information. DECperformance Solution (DECps) is an integrated set of VMS layered products that provide performance and capacity management. The tools provide "what if" analysis allows the user to preview the effects of changes in operation before they are made. Resource accounting is easily accomplished by generating a report of changes based on system utilization. The DECps Performance Advisor provides performance analysis. The DECps Capacity Planner software determines system performance for various workloads and configurations. The Data Accounting Chargeback software allocates charges for resource usage. The Data Collector software ties the other three elements of the product suite together by gathering and managing VMS system data according to user specified requirements. Data collection takes place at each node according to a user defined schedule.

p. Tool. **HINDSIGHT**

(1) Metric(s) supported. Complexity.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported. SUN 4.0.3+,IBM RS/6000, HP 9000, Apollo, DEC / C, FORTRAN

(available in 3rd QTR of 1992), C++ (available in 4th QTR of 1992).

(5) Vendor address/telephone.

Advanced Software Automation Inc.
2880 Lakeside Drive Suite 226
Santa Clara, Ca, 95054
(408) 492-1668

(6) Vendor supplied information. HINDSIGHT is a complete, fully integrated software maintenance environment. It automates software maintenance and testing, structure charts, logic flow diagrams, test coverage analysis, performance analysis, automatically generated reports, and global VAL analysis.

q. Tool. **HP GlancePlus UX Software for HP 9000 Systems**

(1) Metric(s) supported. Computer resource utilization.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Provides graphical displays in real-time.

(4) Platform(s)/language(s) supported. HP 9000 Series including Series 300, 400, 600, 700, 800,and LAN configurations.

(5) Vendor address/telephone.

Hewlett-Packard
Building 51L
5301 Stevens Creek Blvd.
Santa Clara, CA 95052-8059
1(800) 637-7740

(6) Vendor supplied information. HP GlancePlus is an easy-to-use tool for viewing HP-UX system performance. It enables system administrators to examine system activity, identify and resolve occasional performance bottlenecks when they take place. Bar graphs show overviews of data, including CPU, disk, memory, and swap utilization. Also provides Network performance information including Network File System and LANs.

r. Tool. **J73AVS and RXVP80**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported.

(a) RXVP80: VAX / FORTRAN.

(b) J73AVS: VAX IBM MAINFRAME / Jovial.

(5) Vendor address/telephone.

General Research Corporation
5383 Hollister Ave
Santa Barbara, CA 93460 USA

(6) Vendor supplied information. J73AVS is a JOVIAL J73 verification and validation tool and RXVP80

is a FORTRAN verification and validation tool. These tools verify semantic consistency of programs. They produce reports based on static and dynamic analysis, including cross reference, calling tree, and timing. GRC offers training, support, and customization.

s. Tool. **Laser RX/UX Performance Management Software for HP 9000 Systems**

(1) Metric(s) supported. Computer resource utilization.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Provides output in ASCII or DOS text file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. HP 9000 Series including Series 300, 400, 600, 700, 800, and LAN configurations.

(5) Vendor address/telephone.

Hewlett-Packard
Building 51L
5301 Stevens Creek Blvd.
Santa Clara, CA 95052-8059
1(800) 637-7740

(6) Vendor supplied information. Laser RX/UX allows you to quickly isolate and analyze system CPU, memory, and I/O bottlenecks, efficiently monitor and analyze computing resource usage over time, easily document system growth and plan for future needs, and uniformly establish and monitor service levels.

t. Tool. **Logiscope**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported. HP 9000, SUN-3, SUN-4, Sparc, Apollo, VAX VMS, IBM RISC, DEC ULTRIX and others contact Logiscope for details / Over 80 Languages and Dialects supported. Contact Logiscope for details.

(5) Vendor address/telephone.

Verilog Inc.
3010 LBJ Freeway, Ste. 900
Dallas, TX 75234
1(800) 424-3095

(6) Vendor supplied information. Logiscope is a source code analyzer that provides complexity analysis and test coverage analysis. Logiscope supports development, testing, maintenance, and reverse engineering activities. Logiscope can generate DOD-STD-2167A standard documents, Kiviat Diagrams, Criteria Graphs, and Source Code Control Graph. Logiscope calculates and reports over thirty different languages including Ada, C, COBOL, FORTRAN, Pascal and PL/1.

u. Tool. **Lotus 1-2-3 @Project Resources**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.

Convergics Corp.
7910 Ivanhoe Ave. Suite 405
La Jolla, CA 92037
(619) 689-2433

(6) Vendor supplied information.

@Project/Resources add-in for 1-2-3 Release 2.x lets you access standard project-management functions via Lotus-style menus. You begin by entering information on the resources, tasks, and constraints associated with your project, using the add-in's 45 @functions when necessary. @DURA, for example, returns the duration of a task, and @FREEFLOAT returns its slack time. With @Project/Resources, you can do critical-path analysis, determine earliest and latest start/finish dates, and produce schedules by resource-limited, resource-level, and task-precedence methods. The package includes a work-time calendar, as well. @Project/Resources produces standard project-management graphs, including Gantt charts, Pert diagrams, and histograms. Graphs can be saved to disk as PIC files and printed by using 1-2-3's PrintGraph program.

v. Tool. **Micro Planner X-Pert 2.0**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.

Micro Planning International Inc.
3801 East Florida Ave. Suite 605
Denver, CO 80210
(415) 389-1420

(6) Vendor supplied information. Micro Planner X-Pert 2.0 supports up to 10,000 activities, 50 subprojects and unlimited interfaces between projects. The package manages large and complex projects with easy viewing, tracking and control. X-Pert 2.0 handles multi-project cost, resource and schedule analysis. Users can customize reports and screens by annotating text and graphics. They open up into X-Pert's 'inner desktop,' where folders and icons representing projects can be organized. Starting with an existing report layout, users can modify and create their own report format, then save it as an icon. Version 2.0 includes MacPlot Professional, a third-party plotter driver that supports most plotters such as Hewlett-Packard, Houston

Instruments and CalComp. X-Pert 1.04 users who have the MPI annual support program can upgrade to 2.0.

w. Tool. **MIL/SOFTQUAL**

(1) Metric(s) supported. Fault profiles.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Provides output in ASCII or DOS text file suitable for storage in personal repository.

(4) Hardware/Software Required. Operates on all compatible IBM PCs, XTs or ATs with a minimum of 640K RAM and a hard disk.

(5) Vendor address/telephone.

The Carmen Group Inc.
PO Box 867689
Plano, TX 75086-7689
(214)867-5089

(6) Vendor supplied information. MIL/SOFTQUAL is an unique software development quality cost tool which helps one comply with the cost and quality requirements of MIL-Q-9858A, and with DOD-STD-2167A. MIL/SOFTQUAL was designed to line up exactly with the DOD-STD-2167A development activities.

x. Tool. **Multitrak**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(a) IBM mainframe

(5) Vendor address/telephone.

Multitrak Software Development Corp.
119 Beach St.
Boston, MA 02111
(617) 482-6677

(6) Vendor supplied information. Multitrak provides "work management" facilities that function from a single centralized database. This database houses all project and resource information to facilitate data sharing among some 200 users. Multitrak describes work management as an extension to conventional project management techniques. Work management provides an infrastructure for enterprise-wide planning, budgeting, management and evaluation of all projects and people in the IS organization. Data on the mainframe is available in real time; no uploading or downloading is required between a workstation and a host, eliminating synchronization problems and enhancing data integrity. Through Multitrak's multiproject architecture, project and resource information can be collected at any level of the specified work breakdown structure, simplifying the task of aggregating and summarizing information for management reports.

y. Tool. **PC Metric**

(1) Metric(s) supported. Complexity.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Utilities are provided to create comma delimited files from the reports. These files can be imported into database and spreadsheet products.

(4) Platform(s)/language(s) supported.

(a) DOS / Ada, Assembler, dBase, C, C++, COBOL, FORTRAN, Modula-2, Pascal, QuickBASIC.

(b) UNIX / Ada, C, C++, UNIX/386, SUN 3/50, SUN 386i, SUNSparc.

(c) VAX / FORTRAN.

(d) MACINTOSH / Pascal.

(5) Vendor address/telephone.

SET Laboratories, Inc.
PO Box 868
Mulino, OR 97042
(503) 829-7123

(6) Vendor supplied information. PC-Metric and UX Metric is a software measurement tool used to analyze source code. It produces two reports, 1) the complexity analysis report which lists metrics values calculated for each function and the combined values for the entire module under consideration, and 2) the exceptions report which highlights all measured values that lie outside of predetermined, user-defined limits. This tool is intended for two types of users, the software developer and the software project manager. The manual is divided into three parts: Part 1 is a tutorial on the field of software metrics including an annotated bibliography; Part 2 describes the installation, configuration and use of the product; and Part 3 instructs users on what to do with the data.

z. Tool. **Primavera Project Planner Version 5.0**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Graphics and text based reports.

(4) Platform(s)/language(s) supported.

(a) 640K RAM, DOS 3.1 or later. 386-based PC or better and 2MB disk space recommended.

(5) Vendor address/telephone.

Primavera Systems Inc.
Two Bala Plaza
Bala Cynwyd, Pa, 19004
(800) 423-0245
(215) 677-8600

(6) Vendor supplied information. Primavera Project Planner, Version 5.0 offers multiple project options, scheduling of up to 100,000 activities per project, and a maximum project span of 80 years. It includes resource management functions that allow users

to define up to 16 different application profiles and specify which profile patterns should be used when allocating various resources to project activities. Users can define custom data items to track cost, project revenue, planned starting dates, and levels of difficulty. An office can assemble schedules of the activities, which range from design reviews and software testing, to demonstration, conversion, debugging and implementation. The schedules show major reviews, commitment dates, key project constraints and project dependencies. Additional new features include a tables format that allows entry of time sheet information for resources and a custom report writer. The package supports several networks including NetWare and VINES and can import and export Lotus 1-2-3, dBASE, and Excel files.

aa. Tool. **Project Scheduler 5**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.

Scitor Corp.
250 Lincoln Centre Dr.
Foster City, CA 94404
(415) 570-7700

(6) Vendor supplied information. Project Scheduler 5 provides the user with the capability to manage multiple projects. You can link projects together in a way that establishes cross-project dependencies by task but maintains the independence of the projects involved. This means that a manager can work with a project and try to resolve schedule and resource problems independently before across-project schedule is updated. Individual managers are flagged that agreements they've made to other managers have slipped, but only when the linked projects are all brought into memory is the cross-project schedule updated. Projects can be dependent on each other even if they don't share resources.

bb. Tool. **QA FORTRAN and QA C**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported.

(a) VMS, ULTRIX, SUN 3, SUN 4, SUNSparc (OS3.5 or later), CRAY UniCOS, HP 9000-300/800, Convex COS, Alliant FX40-81, FX2800, Solbourne, Silicon Graphics Personal Iris workstations / FORTRAN.

(b) ULTRIX, SUN 3, SUN 4, SUNSparc (OS3.5 or later), CRAY UniCOS, HP 9000-300/800, Convex COS, Alliant FX40-81, FX2800, Solbourne, Silicon Graphics Personal Iris workstations / C.

(5) Vendor address/telephone.

PROGRAMMING RESEARCH CORPORATION
Suite 520
8701 Bedford-Euless Road
Hurst, TX 76053
(817)589-0949

(6) Vendor supplied information. QA C is a toolset for analyzing, improving, and maintaining C programs. Based on ANSI validated technology to check for over 500 reliability, portability, and maintenance issues within the C Language. QA FORTRAN is a toolset for analyzing, improving, and maintaining FORTRAN programs. Checks for hundreds of reliability, portability, and maintenance issues and computes 28 quality metrics about the code.

cc. Tool. **RTM**

(1) Metric(s) supported. Requirements traceability, requirements stability, design stability, breadth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. Application supports all platforms. It operates under SUN, DEC or HP systems.

(5) Vendor address/telephone.

Marconi Systems Technology
1111 Jefferson Davis Hwy
Arlington, VA 22202
(703) 920-7581

(6) Vendor supplied information. RTM supports entire SDLC. Data base is a VCRI (Verification Cross Reference Index). Requirements stripping includes transferring requirements into the data base. Users may scan original requirements documents by line or string search. Engineering requests are classified into keywords. Interface with Teamwork, Software through Pictures CASE tools and others. Supports DOD-STD-2167A format.

dd. Tool. **RTrace**

(1) Metric(s) supported. Requirements traceability, requirements stability, design stability, breadth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file suitable for storage in personal repository.

(4) Platform(s)/language(s) supported. SUN 3, SUN 4, VAX/VMS, IBM RS6000. Interfaces with teamwork

and Software Through Pictures.

(5) Vendor address/telephone.

PROTOCOL
500 International Drive
Mt. Olive, NJ 07828
(201) 347-7900

(6) Vendor supplied information. RTrace is a powerful requirements management tool. It supports all phases of a system's life including design, development, test and post deployment change evaluation.

ee. Tool. **Statistical Modeling and Estimation of Reliability Function for Software (SMERFS)**

(1) Metric(s) supported. Reliability.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports.

(4) Platform(s)/language(s) supported: Application supports all platforms and runs under any operating system on any type of computer with a Fortran compiler.

(5) Vendor address/telephone.

Naval Surface Warfare Center
Dahlgren, VA 22448
(703) 663-7927

(6) Government supplied information. SMERFS is a series of reliability modeling tools developed to accommodate a variety of environmental and behavioral characteristics experienced by software intensive systems during testing. The SMERFS performs five different kinds of operations on software failure data: data transformations, data statistics, plots of the original data, processing of data through one of ten reliability models, and an analysis of the "goodness of fit" between the actual testing data and the failure rate projections of each model used. The selection of a reliability model within SMERFS depends upon two factors: the timing mode used for tracking error data (these include clock time, computer time or testing interval time) and the assumptions surrounding the use of a particular model. Once the selection of a model is limited to one of the two groups based on the timing mode used, the user must then consider the assumptions underlying the use of each model within that group before making a final selection. (These assumptions are described in the SMERFS User's Manual NAVSWC TR 84-373). The use of clock time and/or computer time for software failure measurement presupposes the use of one of the five following models: Littlewood and Verral Bayesian, Musa Basic Execution Time, Geometric, Nonhomogenous Poisson Process (for time between error occurrence), or the Musa Log Poisson Execution Time. If software failures are tracked within testing intervals then one of the five following models are

used: Generalized Poisson, Nonhomogenous Poisson, Brooks and Motley, Schneidwind, or the S-Shaped Reliability Growth. SMERFS is free to any government agency or private company (a token fee may be required for materials and handling.)

ff. Tool. **TCAT and TCAT-PATH**

(1) Metric(s) supported. Depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Provides output in ASCII file.

(4) Platform(s)/language(s) supported.

(a) TCAT: UNIX, MS-DOS, OS/2, AIX, XENIX / C, C++, Ada, COBOL, FORTRAN.

(b) TCAT-PATH: UNIX, MS-DOS, OS/2, AIX, XENIX / C.

(5) Vendor address/telephone.

Software Research Inc.
625 Third St.
San Francisco, CA 94107-1997
1(800) 942-7638

(6) Vendor supplied information. TCAT measures structural completeness at the module level using the logical segment, or "C1" metric, employing source instrumentation techniques. TCAT is a powerful aid to unit and small system testing. Coverage reports show segment hit, not-hit, cumulative percentages, and histograms. TCAT-PATH measures module level test coverage at path level using source instrumentation techniques. An algorithm generates set of all possible execution paths.

gg. Tool. **TESTBED**

(1) Metric(s) supported. Complexity, depth of testing.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text report. Output provided in standard interface file.

(4) Platform(s)/language(s) supported. All Major Platforms / Ada, C, Pascal, FORTRAN, PL/1, PL/M, COBOL.

(5) Vendor address/telephone.

Program Analysers
56 Northbrook Street
Newbury, Berkshire
UK, RG13 1AN
011-44-635-52-8828

(6) Vendor supplied information. TESTBED comprises both Static Analysis and Dynamic Analysis modules. In the static domain, source code is analyzed to give information on control flow, logical complexity, data flow and variable usage. In the dynamic domain, the execution of an instrumented version of the source code is monitored to provide

coverage metrics and report violations of assertions. The information obtained is presented in a series of report files.

hh. Tool. **Tracker/3000**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.

GBS Consultants Inc.
6087 South Quebec, Suite 101
Englewood, CO 80111
(303) 721-077

(6) Vendor supplied information. Tracker/3000 offers management controls within the work unit, distribution of work loads, prioritization of end user requests and problems, measurement of individual and departmental performance standards, equipment inventory,maintenance records and service call status. Tracker/3000 also offers a hardware and software inventory tracking system.

ii. Tool. **Ultra Planner**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.

Productivity Solutions
36 Washington St.
Wellesley, MA 02181
(617) 237-1600

(6) Vendor supplied information. Ultra Planner can centrally control and monitor projects divided into elements, which are distributed among various individuals, and roll up those project segments to a major project level. Ultra Planner was developed to bridge the gap between easy-to-use PC-style products and the superuser products. For example, the user can quickly develop a work breakdown structure that is intuitive and requires no restrictive coding scheme. Project data can reside on multiple computers, yet the information can be viewed and/or modified in real time, and in a seamless manner.

jj. Tool. **VIA/SmartDoc**

(1) Metric(s) supported. Complexity.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output. Text reports. Updated version due in 4th Quarter FY92 will provide output in ASCII file.

(4) Platform(s)/language(s) supported. MVS: COBOL.

(5) Vendor address/telephone.
VIASOFT
3033 North 44th Street
Phoenix, Arizona 85018
1-(800)525-7775

(6) Vendor supplied information. VIA/SmartDoc is a static analysis and documentation generator that provides IS professionals with comprehensive information about COBOL programs on demand. This includes a wide array of documentation and program level metrics besides those detailed above.

kk. Tool. **Viewpoint**

(1) Metric(s) supported. Cost, schedule.

(2) Data elements subject to automation: See corresponding candidate metric tool table(s).

(3) Output.

(4) Platform(s)/language(s) supported.

(5) Vendor address/telephone.
Computer Aided Management Inc.
1318 Redwood Way, Suite 210
Petaluma, Ca
(800) 635-5621

(6) Vendor supplied information. Viewpoint is a cost-scheduling utility for its ViewPoint high-end project-management program. ViewPoint/CSI, automates data transfer between schedule data in ViewPoint and cost data in M*PM, the cost-schedule control system from Micro-Frame Technologies Inc., thus eliminating the need to rekey data.

D-20. Tool candidate summary

a. Table D-12 identifies all the tools that were reviewed to prepare this appendix. The name and telephone number of each product's vendor is supplied. The status column of the table represents the results of the review. There are three categories of findings.

(1) Failed criteria. The tool was unable to meet the criteria stated in paragraph D-2 for any of the metrics.

(2) Failed to respond. The vendor failed to respond to the survey form or failed to return telephone calls made on behalf of the review.

(3) Candidate. The tool satisfies the criteria of paragraph D-2. This in no way represents an endorsement of the tool in terms of its functionality, cost, usability or any other factor other than those specified in paragraph D-2.

b. The target metrics column of Table D-12 identifies the metrics for which the tool was examined. It is possible that the tool may address other metrics as well.

c. Figure D-1 graphically represents the overall results of the metrics tool candidate preliminary survey.

Table D-12. Metric Tool Candidate Summary

TARGET METRICS				TOOL	STATUS	VENDOR	TELEPHONE
CPX	DOT			ACT	Candidate	McCabe Assoc.Inc.	301-596-3080
CPX				ADAMAT	Candidate	Dynamic Research	508-475-9090
CPX	DOT			AdaCount	Failed Criteria	ALSYS Inc.	617-270-0030
CPX				AdaQuest	Candidate	General Research	805-964-7724
DOT				AdaRAID	Candidate	Proprietary SW Systems	213-394-5233
DOT				AdaTune	Candidate	ALSYS Inc.	617-270-0030
RQT	BOT	DOT		Adagen	Failed to Respond	Mark V Systems Ltd.	818-995-7671
RQT				Aisle	Failed to Respond	SoftwareSystems Design	714-625-6147
CRU	DSB	BOT	FLT	ADAS	Failed to Respond	Research Triangle	919-541-6629
CST	SCH			Artemis	Candidate	Lucas Management	703-222-1111
DOT				AutoFlow-C	Candidate	AutoCASE Technology	408-446-2273
DOT				Basis Branch Anal	Failed to Respond	Hewlett-Packard	800-538-8787
CPX				Battlemap Anal	Failed Criteria	McCabe Assoc. Inc.	301-596-3080
CPX	DOT			C-DOC	Failed Criteria	Software Blacksmith	416-858-4466
CPX	DOT			C-Metric	Candidate	Software Blacksmith	416-858-4466
CST	SCH			CA-Superproject	Candidate	Computer Associates	800-237-9273
RQT				CARDtools	Failed to Respond	CARDtools Systems	408-559-4240
RQT	RQS	DSB	BOT	CASEmate	Failed to Respond	Concurrent Computer	800-631-2154
DOT				CMS-2 Code Audit	Candidate	Fleet Combat Dir.	619-553-9446
CPX				CMS-2 Test Cover	Candidate	Fleet Combat Dir.	619-553-9446
CST	SCH			COSTAR	Failed Criteria	Softstar Systems	603-672-0987
DOT				CAP/PLAY TL for X	Failed Criteria	Software Research	415-957-1441
DOT				cflow	Failed to Respond	Digital Equipment	800-332-4636
RQT	RQS	DSB	BOT	CCC	Failed Criteria	Softool Corp	805-683-5777
RQT	RQS	DSB	BOT	Checkpoint	Candidate	Software Productivity Research	617-273-0140

CST - COST
SCH - SCHEDULE
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RQT - REQUIREMENTS TRACEABILITY
RQS - REQUIREMENTS STABILITY

DSB - DESIGN STABILITY
CPX - COMPLEXITY
BOT - BREADTH OF TESTING
DOT - DEPTH OF TESTING
FLT - FAULT PROFILES
RLY - RELIABILITY

Table D-12. Metric Tool Candidate Summary (Cont'd.)

TARGET METRICS				TOOL	STATUS	VENDOR	TELEPHONE
CPX	DOT			CodeMap	Candidate	CADRE Technology	408-562-0106
RQT	RQS	DSB	BOT	Config Mgmt Fac	Failed to Respond	Expertware Inc.	408-746-0706
FLT				DDTs	Candidate	QualTrak Corp.	408-730-2674
CRU				DECps	Candidate	Digital Equipment	800-332-4636
RQT	RQS	DSB	BOT	Delta/1000	Failed to Respond	Corporate Computer Systems	908-946-3800
CPX				Design Cpx Tool	Failed to Respond	McCabe Assoc. Inc.	301-596-3080
RQT	RQS	DSB	BOT	DocGen	Failed to Respond	SW Systems Design	714-625-6147
RQT	RQS	DSB	BOT	EPOS	Failed to Respond	SPS SW Products & Services	212-686-3790
RQT	RQS	DSB	BOT	Excelerator	Failed to Respond	Intersolv	301-230-3200
DOT				FORTRAN Test Ins	Failed Criteria	Softool Corp.	805-683-5777
CPX	DOT			FPXpert	Failed Criteria	Howard Rubin Assoc.	617-861-7171
RQT				Gaia	Failed Criteria	Honeywell Inc.	612-782-7327
CPX	DOT			HP 64000 UX Micro	Failed Criteria	Hewlett-Packard	801-974-1700
CPX	DOT			HP AxAda Prg Supp	Failed Criteria	Hewlett-Packard	801-974-1700
CRU				HP GlancePlus UX	Candidate	Hewlett-Packard	800-637-7740
CPX				Hindsight	Candidate	Advance Software Automation	408-492-1668
DOT				J73AVS & RXVP80	Candidate	General Research	805-964-7724
CRU				Laser RX/UX	Candidate	Hewlett-Packard	800-637-7740
CPX	DOT			Logiscope	Candidate	Verilog, Inc.	800-424-3095
CST	SCH			Lotus 123/Project	Candidate	Convergics Corp.	619-689-2433
RQT	RQS	DSB	BOT	Maestro II	Failed Criteria	Softlab, Inc.	201-239-3888
FLT				MIL/SOFTQUAL	Candidate	The Carman Group	214-867-5089
CST	SCH			MicroPlanner	Candidate	Micro Planning Int.	415-389-1420
CST	SCH			Multitrak	Candidate	Multitrak Software Development Corp.	617-482-6677
CPX	DOT			PC/UX/VX Metric	Candidate	Set Laboratories	503-829-7123

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Table D-12. Metric Tool Candidate Summary (Cont'd.)

TARGET METRICS				TOOL	STATUS	VENDOR	TELEPHONE
CST	SCH			Primavera	Candidate	Primavera Systems	800-423-0245
RQT	CPX	DSB	BOT	ProMod Plus	Failed to Respond	Meridian Software	800-255-2689
CST	SCH			Project Schedular	Candidate	Scitor Corp.	415-570-7700
CPX	DOT			QA C & QA FORTRAN	Candidate	Programming Research	817-589-0949
RQT	RQS	DSB	BOT	R-Trace	Candidate	Protocol	313-953-5800
RQT	RQS	DSB	BOT	RDD	Failed to Respond	Ascent Logic Corp.	203-245-7400
CST	SCH			REVIC	Failed Criteria	Air Force Cost Anal.	619-553-5973
RQT	RQS	DSB	BOT	RT Tool	Failed to Respond	Teledyne Brown	800-633-4675
RQT	RQS	DSB	BOT	RTM	Candidate	Marconi Systems	703-920-7581
CPX	DOT			S-TCAT	Failed Criteria	Software Research	800-942-7638
RQT				STRIPS	Failed Criteria	AMS	703-841-6000
DOT				SW Anal Test Tool	Failed Criteria	IBM Corp	800-426-3333
CST				SW Cost Est Model	Failed Criteria	NASA	404-542-3265
CPX	DOT			SW Qual Mgmt Sys	Failed Criteria	SW Quality Tools	508-366-5045
RQT	RQS	DSB	BOT	SW Thru Pictures	Failed to Respond	Interactive Develop -ment Environment	415-543-0900
DOT				Safe C Runtime	Failed Criteria	Blossom/Catalytix	617-738-1516
RLY				Stat. Model & Est Rely Func (SMERF)	Candidate	Naval Surface Warfare Center	703-663-7927
CPX				START	Failed Criteria	McCabe Assoc. Inc.	800-638-6316
RQT				Struct. Archt.	Failed to Respond	LBMS	800-333-6382
RQT	DOT	BOT		T	Failed to Respond	Programming Environments	908-918-0110
CPX	DOT			T-Scope	Failed Criteria	Software Research	800-942-7638
DOT				TADS	Failed to Respond	UNISYS	313-972-7000
RQT	RQS	DSB	BOT	TAGS Case 2 Tool	Failed to Respond	Teledyne Brown	800-633-4675
DOT				TCAT & TCAT-PATH	Candidate	Software Research	416-957-1441
CPX	DOT			TESTBED	Candidate	Program Analyzers	44 635 528828

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Table D-12. Metric Tool Candidate Summary (Cont'd.)

TARGET METRICS				TOOL	STATUS	VENDOR	TELEPHONE
RQT	RQS	DSB	BOT	Teamwork/Ada	Failed to Respond	CADRE Technology	401-351-5950
RQT	RQS	DSB	BOT	Toolset 2167A	Failed Criteria	Adv Sys Technology	301-261-0862
CST	SCH			Tracker 3000	Candidate	GBS Consultants	303-721-0777
CPX				UNISET	Failed to Respond	UNISYS	313-972-7000
CST	SCH			UltraPlanner	Candidate	Productivity Solutions	617-237-1600
RQT	RQS	DSB	BOT	VASTT	Failed Criteria	Vitro Corp.	301-231-1358
DOT				VAX PCA	Failed to Respond	Digital Equipment	800-332-4636
DOT				VAXset	Failed to Respond	Digital Equipment	800-332-4636
CPX				VIA/SmartDoc	Candidate	VIASOFT	602-952-0050
DOT				VIA/SmartTest	Failed Criteria	VIASOFT	602-952-0050
RQT	RQS	DSB	BOT	VISTA	Failed Criteria	Vitro Corp	301-231-1358
CST	SCH			VSEM	Failed Criteria	Vitro Corp	301-231-1358
CST	SCH			Viewpoint	Candidate	Computer Aided Mgmt	800-635-5621

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DSB - DESIGN STABILITY
CPX - COMPLEXITY
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DOT - DEPTH OF TESTING
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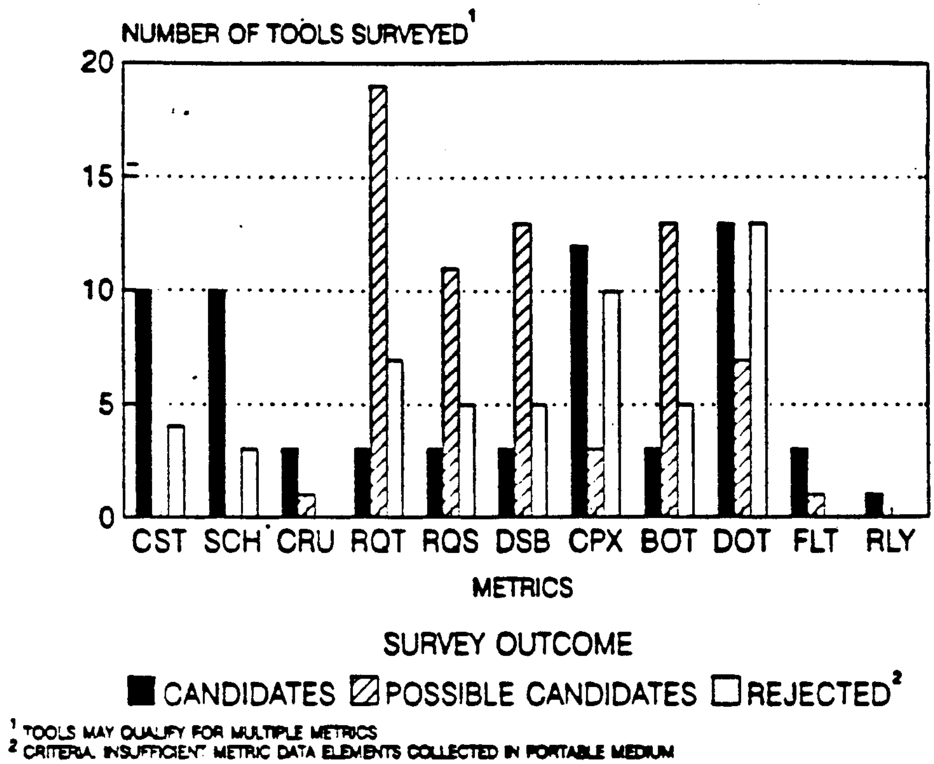

Figure D-1. Candidate Tools for Metrics Collection and Reporting

Glossary

Section I
Terms and Definitions

Allocated Baseline
The initial, approved performance oriented specification governing the development of configuration items (CIs) that are part of a higher level CI, in which each specification (a) defines the functional characteristics that are allocated from those of the higher level CI, (b) establishes the tests required to demonstrate achievement of its allocated functional characteristics, (c) delineates necessary interface requirements with other associated configuration items, and (d) establishes design constraints, if any, such as component standardization, use of inventory items and integrated logistics support requirements. (Reference DOD-STD-480A)

Automated Information System (AIS)
A combination of information, computer and telecommunications resources and other information technology and personnel resources that collects, records, processes, stores, communicates, retrieves, and displays information. (Reference DOD-STD-7935A)

Baseline
A configuration identification document or a set of documents formally designated and fixed at a specific time during a configuration item's life cycle. Baseline, plus approved changes from those baselines constitute the current configuration. (Reference DOD-STD-480A)

Benchmark Test Files (BMTF)
A data base of known content against which a controlled set of inputs is processed and from which output results may be predicted. This term is used in reference to a test environment and pre-established test cases/data.

CASE Tools
Systems for building systems; automates the requirements analysis, design and development process.

Code Walk-through
The process of assessing the level of software performance and design structure that requires the developer to demonstrate the capabilities of the software to technical, functional, and user representatives.

Computer Resources
The totality of computer personnel, documentation, services, and supplies applied to a given effort. This includes hardware, software, services, personnel, documentation and supplies. (Reference DOD-STD-2167A)

Computer Resources Management Plan (CRMP) or Computer Resource Life Cycle Management Plan (CRLCMP)
The primary planning document to be used at all decision levels for assessing the adequacy of the overall computer resources management efforts throughout the system life cycle. Used only for AR 70-1 developed systems. (Reference AR 70-1, DODI 5000.2)

Computer Resources Work Group (CRWG)
Established by the Material Developer after Milestone I for each AR 70-1 system to aid in the management of system computer resources. The CRWG assists in insuring compliance with policy, procedures, plans and standards established for computer resources.

Computer Software Component (CSC)
A distinct part of a computer software configuration item (CSCI). CSCs may be further decomposed into other CSCs and Computer Software Units (CSUs). (Reference DOD-STD-2167A)

Computer Software Configuration Item (CSCI)
An aggregation of software or any of its discrete portions, which satisfies an end use function and is designated by the Government for Configuration Management. (Reference DOD-STD-2167A)

Computer Software Unit (CSU)
An element specified in the design of a Computer Software Component (CSC) that is separately testable. (Reference DOD-STD-2167A)

Configuration Item (CI)
An aggregation of hardware/software, or any of its discrete portions, which satisfy an end use function and is designated by the Government for configuration management. (Reference DOD-STD-480A)

Configuration Management
A discipline applying technical and administrative direction and surveillance to (a) identify and document the functional and physical characteristics of a configuration item, (b) control changes to those characteristics, and (c) record and report change processing and implementation status. (Reference DOD-STD-480A)

Critical Design Review (CDR)
A review conducted to determine that the detail design satisfies the performance and engineering requirements of the development specification; to establish the detail design compatibility among the item and other items of equipment, facilities, computer programs, and personnel; to assess producibility and risk areas; and to review the preliminary product specification. (Reference MIL-STD-1521B)

Cycle/System Test
The final phase of developer's testing which involves the testing of modules/programs/cycles which are integrated into the total system.

Developer Tests
Testing, modeling, and experimentation conducted by the system developer. Formal tests normally involve system level integration and certification by the developer with formal government monitoring. Informal tests involve lower level code and unit development with internal integration between system elements. Experimentation includes a wide variety of tests, models, development techniques and simulations used to validate design concepts and theories.

Developmental Tests (DT)
Tests usually conducted by an organization independent of the developer(s) in order to validate total system conformance to technical and functional specifications and ensure the system is ready for formal or limited user testing. Formal tests focus primarily on total systems integration. Limited tests are used primarily with priority 1, 2, or 3 changes during PDSS and focus on the specific changes being made.

Development Tools
Products which are necessary to prepare, test and evaluate software units currently under development.

Driver
Software which performs two functions: control of an external hardware device or controlling the execution of other programs.

Dynamic Analysis
Involves execution or simulation of a development phase product. It detects errors by analyzing the response of a product to sets of input data.

Emulation
An interpretation similar to simulation, however, the interpretation is done through hardware or microcode or the process of using software or peripherals to make one set of hardware operate like another.

Engineering Change Proposal - Software (ECP-S)
A term which includes both a proposed engineering change and the documentation by which the change is described and suggested. DA Form 5005-R is used to document proposed changes to software baselines and associated baseline documentation. (Reference DOD-STD-480A)

Firmware
A combination of a hardware device and computer instructions or computer data that reside as read-only software on the hardware device. The software cannot be readily modified under program control. (Reference DOD-STD-2167A)

Formal Qualification Testing (FQT)
A process that allows the contracting agency to determine whether a configuration item (subsystem) complies with the allocated requirements for that item. (Reference DOD-STD-2167A)

Functional Baseline
The initial, approved technical documentation for a configuration item which prescribes (a) all necessary functional characteristics, (b) the tests required to demonstrate achievement of specified functional characteristics, (c) the necessary interface characteristics with associated CIs, (d) the CI's key functional characteristics and its key lower level CIs, if any, and (e) design constraints, such as, envelope dimensions, component standardization, use of inventory items, and integrated logistics support policies. (Reference DOD-STD-480A)

Functional Configuration Audit (FCA)
A formal audit to validate that the development of a configuration item has been completed satisfactorily and that the configuration item has achieved the performance and functional characteristics specified in the functional or allocated configuration identification. In addition, the complete operation and support documents are required. (Reference MIL-STD-1521B)

Implementation Procedures (IP)
A document developed in accordance with DOD-STD-7935A which provides information to the user and data processing personnel to install the AIS and achieve operational status.

Independent Verification and Validation (IV&V)
Verification and validation performed by a contractor or Government agency that is not responsible for developing the product or performing the activity being evaluated. IV&V is tailored to the risk associated

with the system. IV&V is conducted separately from the software development activities. (Reference DOD-STD-2167A)

Interface
The process of passing data between systems.

Interim Change Package (ICP)
A software modification release of ECP-s which, because of urgency, regulatory requirement or special need, must be provided before the availability of the next scheduled Software Change Package.

Interoperability
The ability of systems, units, or forces to provide services to and accept services from other systems, units or forces and to use the services to enable them to operate effectively together.

Issues and Criteria
Issues are questions, the answers to which permit the overall system evaluation. Criteria are the quantitative or qualitative standards by which issues are evaluated.

Lead-Site Verification Test (LSVT)
A system test in a selected operational environment where an Interim System Change Package (ICP) is evaluated to determine if it meets the ICP's goals and objectives.

Left-of-Baseline (LOB)
The manual and automated processes of extracting selected data and reducing them to input file and transaction formats acceptable for building or initializing a data base for a new system. Normally associated with conversion requirements or parallel testing.

Materiel Systems Computer Resources (MSCR)
Computer resources acquired for use as integral parts of weapons; command and control; communications; intelligence and other tactical or strategic systems and their support systems. The term also includes all computer resources associated with specific program developmental T&E, operational testing, and post deployment software support including weapon system training devices, automatic test equipment, land-based test sites, and system integration and test environments.

Metrics
A quantitative value, procedure, methodology, and/or technique which allows one the ability to measure various aspects and characteristics of software.

Nondevelopmental Item (NDI)
Deliverable items that are not developed under the contract but are provided by the contractor, the Government or a third party. NDI may be referred to as reusable, Government furnished, or commonly available software, hardware or total systems, depending upon the source. (Reference DOD-STD-2167A)

Parallel Testing
Testing that demonstrates whether or not two versions of the same application are consistent, or two systems performing the same function.

Physical Configuration Audit (PCA)
The technical examination of a designated configuration item to verify that the configuration item "as-built" conforms to the technical documentation which defined the CI. (Reference MIL-STD-1521B)

Preliminary Design Review (PDR)
This review is conducted for each configuration item or aggregate of configuration items to (1) evaluate the progress, technical adequacy, and risk resolution (on a technical, cost, and schedule basis) of the selected design approach, (2) determine its compatibility with performance and engineering specialty requirements of the Hardware Configuration Item (HWCI) development specification, (3) evaluate the degree of definition and assess the technical risk associated with the selected manufacturing compatibility of the physical and functional interfaces among the configuration item and other items of equipment, facilities, computer software, and personnel. For CSCIs, this review focuses on: (1) the evaluation of the progress, consistency, and technical adequacy of the selected top-level design and test approach, (2) compatibility between software requirements and preliminary design, and (3) on the preliminary version of the operation and support documents. (Reference MIL-STD-1521B)

Program
A separately compilable, structural (closed) set of instructions most precisely associated with early generations of computers. Synonymous with computer program. Contrast with Software Unit. (Reference DOD-STD-7935A)

Program Folder
A repository collecting material pertinent to the development or support of software. Contents typically include (either directly or by reference), design considerations and constraints, design documentation and data, schedule and status information, test requirements, test cases, test procedures and test results.

Recovery/Reconfiguration Testing
Testing that verifies the recovery process and component parts' effectiveness. It validates that enough backup data is preserved and stored in a secure location.

Regression Testing
Testing of a computer program to assure correct performance after changes were made to code that previously performed correctly, or the process entails testing or retesting those areas/aspects of a system which will or could be affected by a change.

Release
A configuration management action whereby a particular version of software is made available for a specific purpose (e.g., released for test). (Reference DOD-STD-2167A)

Required Operational Characteristics
Qualitative and quantitative system performance parameters, proposed by the user and approved by the Army, that are primary indicators of a system's capability to accomplish its mission (operational effectiveness) and to be supported (operational suitability). Required operational characteristics are usually tested and evaluated by operational testing and evaluation to ascertain achievement of approved goals and thresholds for these characteristics.

Required Technical Characteristics
Quantitative system performance parameters approved by the Army management that are selected as primary indicators of technical achievement. These might not be direct measures of, but always should relate to a system's capability to perform its required mission function and to be supported. Required technical characteristics usually are tested and evaluated to ascertain approval goals and thresholds for these characteristics.

Requirements Trace
Assuring requirements flow from the user specifications through design and implementation of the product.

Right-of-Baseline (ROB)
The automated process of building a data base from LOB products, or the initialization of new files introduced for the first time. Normally associated with conversion requirements or parallel testing.

Simulation
The process of conducting experiments with a model for the purpose of understanding the behavior of the system. Simulations may be dynamic, engineering

(scientific), environmental, instruction-level, statement-level, and system level. For AIS, simulation entails summary files to simulate an internal or external interface input. (Reference DODD 5000.3-M-1)

Software Acceptance Test (SAT)
A operational test of a new system or changes to a deployed system, directed by an independent tester and conducted in a field environment using a production data base and executed on target hardware.

Software Change Package
One or more changes which have been approved and scheduled for implementation, as a group, by the appropriate configuration control board IAW DOD-STD-480A.

Software Development Folder (SDF)
A repository for a collection of material pertinent to the development or support of software. Contents typically include (either directly or by reference), design considerations and constraints, design documentation and data, schedule and status information, test requirements, test cases, test procedures and test results. (Reference DOD-STD-2167A)

Software Development Library (SDL)
A controlled collection of software, documentation, and associated tools and procedures used to facilitate the orderly development and subsequent support of software. The SDL includes the developmental configuration as part of its contents. A software development library provides storage of and controlled access to software and documentation in human-readable form, machine-readable form, or both. The library may also contain management data pertinent to the software development project. (Reference DOD-STD-2167A)

Software Engineering Environment (SEE)
Set of automated tools, firmware devices, and hardware necessary to perform the software engineering effort. The automated tools may include but are not limited to compilers, assemblers, linkers, loaders, operating systems, debuggers, simulators, emulators, test tools, documentation tools, and data base management systems. (Reference DOD-STD-2167A)

Software Qualification Test (SQT)
Independent developmental test conducted on target hardware, but normally not in an operational environment.

Software Specification Review (SSR)
A review of the finalized software configuration item requirements and operational concept. The SSR is

conducted when software requirements have been sufficiently defined to evaluate the developer's responsiveness to and interpretation of the system, segment or prime item level requirements. (Reference MIL-STD-1521B)

Software Test Environment
A set of automated tools, firmware devices, and hardware necessary to test software. The automated tools may include but are not limited to test tools such as simulation software, code analyzers, etc., and may also include those tools used in the software engineering environment (SEE). (Reference DOD-STD-2167A)

Software Unit
Any logical set or groupings of instructions to a computer, such as a module or package. (Reference DOD-STD-7935A)

Statement of Work (SOW)
A statement of contract requirements that is used for defining and achieving program goals. The SOW provides the basic framework for a particular effort. It is a document by which all nonspecification requirements for developer efforts must be established and defined either directly or with the use of specific cited documents.

Static Analysis
Direct analysis of the form and structure of a product without executing the product. It may be applied to requirements, design, or code.

Stress Test
A program which exercises code up to, including and beyond all stated limits in order to exercise all aspects of the system (e.g., to include hardware, software, and communications). The purpose is to insure that response times and storage capacities meet requirements.

Supplemental Site Test
Testing conducted on multi-vendor and/or multi-operating system environment or for conditions/functions not readily available at a primary test site.

Supportability
The degree to which a system can be maintained or sustained in an operational environment.

System Change Package (SCP)
A group of modifications documented on ECP-S which are packaged and implemented during post deployment phase.

System Decision Paper
The primary document used to obtain MAISRC approval for information systems.

System Design Review (SDR)
This review is conducted to evaluate the optimization, correlation, completeness, and risks associated with the allocated technical requirements. Also included is a summary review of the system engineering process which produced the allocated technical requirements and of the engineering planning for the next phase of effort. This review is conducted when the system definition effort has proceeded to the point where system characteristics are defined and the configuration items are identified. (Reference MIL-STD-1521B)

System Post-Deployment Review (SPR)
A review conducted after deployment of the initial system to evaluate how well the operational system is satisfying user requirements.

System Requirements Review (SRR)
The objective of this review is to ascertain the adequacy of efforts in defining system requirements. It is conducted when a significant portion of the system functional requirements has been established. (Reference MIL-STD-1521B)

System Specification
A system level requirements specification. A system specification may be a System/Segment Specification, Prime Item Development Specification (PIDS), or Critical Item Development Specification (CIDS). (Reference DOD-STD-2167A)

Target Hardware
Suite of hardware designated as the operational configuration of the system.

Test and Evaluation Master Plan (TEMP)
The key management tool for control of the integration of all T&E requirements for each acquisition effort and is used by decision review bodies. (Reference DOD 5000.2-M and DOD 7920.2-M)

Test Bed
A system representation consisting partially of actual hardware and/or software and partially of computer models or prototype hardware and/or software. (Reference DODI 5000.2)

Test Condition Requirement (TCR)
Represents a specific testable criteria or sub-function of a system. Often composed of further subordinate

levels of test items and specific test cases. It may represent a test scenario or be an element of a larger scenario. ECP-S's include test conditions. A test condition requirement includes five elements:

1. Input instructions references (i.e., user's manual paragraph).
2. Validation standard/criteria reference (i.e., FD or regulation).
3. Data parameters or specific input data requirements for underlying cases.
4. Cross reference to other TCRs as appropriate.
5. Primary output products to be used for validation (i.e., file dumps, specific reports, screen inquiries).

Test Hooks
Software logic which is integrated into the system in order to facilitate extraction of data to support test and analysis.

Test Integration Working Group (TIWG)
Established by the program sponsor upon receipt of the draft Operational Requirements Document or Mission Needs Statement. This is the primary group which facilitates integration of T&E requirements and prepares the TEMP.

Test Readiness Review (TRR)
A review conducted for each CSCI to determine whether the software test procedures are complete and to assure that the contractor is prepared for formal CSCI testing. (Reference MIL-STD-1521B)

Unit Test
The lowest level developer test.

User or Operational Tests
A system-level test performed by a test activity independent of the developer or the PM. The objective of the OT is to test the entirety of the system and is performed by users in an operational environment.

Validation
The process of evaluating software to determine compliance with specified requirements. (Reference MIL-STD-2167A)

Verification
The process of evaluating the products of a given software development activity to determine correctness and consistency with respect to the products and standards provided as an input to that activity. (Reference DOD-STD-2167A)

Version
An identified and documented body of software. Modifications to a version of software (resulting in a new version) require configuration management actions by the contractor, the contracting agency or both. (Reference DOD-STD-2167A)

Version Description Document (VDD)
A document containing a description of the software version for a specific CSCI or subsystem. It contains all corrective actions written and resolved. It may contain loading instructions and other specific information to this software version.

Walk-through
An informal, step-by-step review of a particular product within the development (i.e., program code, test scenario, functional design) which allows feedback from other members of the development team to the creator of the particular product being reviewed.

Section II
Acronyms

AAE ..... Army Acquisition Executive
ACAT .... Acquisition Category
AdaIC ... Ada Information Clearinghouse
ADP ..... Automated Data Processing
AI ...... Artificial Intelligence
AIN ..... Army Interoperability Network
AIS ..... Automated Information System
AMC ..... Army Materiel Command
AMSAA ... Army Materiel Systems Analysis Activity
AOA ..... Abbreviated Operational Assessment
ASAP .... Army Streamlined Acquisition Program
ASARC ... Army Systems Acquisition Review Council
ASIOE ... Associated Support Items of Equipment
ATCCS ... Army Tactical Command and Control System
ATE ..... Automated Test Equipment
ATIRS ... Army Test Incident Report System

BOIP .... Basis of Issue Plan
BMTF .... Benchmark Test Files

CAP ..... Corrective Action Plan
CASE .... Computer Aided Software Engineering
CAIS .... Common Ada Programming Support Environment Interface Set
CBTDEV .. Combat Developer
CCB ..... Configuration Control Board
CDA ..... Central Design Activity
CDR ..... Critical Design Review
CDRL .... Contract Data Requirements List
CE ...... Continuous Evaluation
CEPT .... Concept Evaluation Program Test
CI ...... Configuration Item
CLS ..... Contractor Logistics Support
CM ...... Configuration Management
CMP ..... Configuration Management Plan
CMS ..... Configuration Management System
COE ..... Corps of Engineers
COIC .... Critical Operational Issues and Criteria
COMPUSEC Computer Security
COMSEC .. Communication Security
CONOPS .. Continuity of Operations Plans
COOP .... Continuity of Operations Plans
CPU ..... Central Processing Unit
CRISD ... Computer Resources Integrated Support Document
CRMP .... Computer Resources Management Plan
CRU ..... Computer Resource Utilization
CRWG .... Computer Resources Working Group
CSC ..... Computer Software Component
CSCI .... Computer Software Configuration Item
CSE ..... Center for Software Engineering

CSTA .... Combat Systems Test Activity
CSU ..... Computer Software Unit

DA ...... Department of the Army
DAA ..... Designated Accreditation Authority
DAB ..... Defense Acquisition Board
DACS .... Data & Analysis Center for Software
DAP ..... Defense Acquisition Program
DASD .... Direct Access Storage Device
DCSOP ... Deputy Chief of Staff Operations and Plans
DE ...... Developmental Evaluator
DID ..... Data Item Description
DISC4 ... Director of Information Systems Command, Control, Communications, and Computers
DLA ..... Defense Logistics Agency
DOD ..... Department of Defense
DODD .... Department of Defense Directive
DODI .... Department of Defense Instruction
DOIM .... Director of Information Management
DOT&E ... Director, Operational Test and Evaluation
DP ...... Design Process
DS ...... Database Specification
DT ...... Developmental Test
DT&E .... Developmental Test and Evaluation
DTP ..... Detailed Test Plan
DTRR .... Developmental Test Readiness Review
DTRS .... Developmental Test Readiness Statement

ECPs .... Engineering Change Proposals
ECP-S ... Engineering Change Proposal - Software
ELSEC ... Electronic Security
EM ...... End User Mannual
EOA ..... Early Operational Assessment
ETR ..... Expanded Test Report
EUE ..... Early User Experimentation
EUT ..... Early User Test
EUTE .... Early User Test and Experimentation

FCA ..... Functional Configuration Audit
FD ...... Functional Description
FDE ..... Force Development Experiment
FDT ..... Force Development Test
FDTE .... Force Development Test and Experimentation
FOT ..... Follow-on Operational Test
FP ...... Functional Proponent
FQT ..... Formal Qualification Test/Testing
FUE ..... First Unit Equipped
FUED .... First Unit Equipped Delivery
FVT ..... Functional Verification Test
FYTP .... Five-Year Test Plan

GSA ..... General Services Administration

HFE ..... Human Factors Engineering
HOL ..... Higher Order Language

HQDA .... Headquarters, Department of the Army
HSC ..... Health Services Command
HUC ..... Human Use Committee
HW ...... Hardware

I/O ..... Input/Output
IAP ..... Independent Assessment Plan
IAR ..... Independent Assessment Report
IAW ..... In Accordance With
ICP ..... Interim Change Package
IDD ..... Interface Design Document
IEB ..... Independent Evaluation Briefings
IEP ..... Independent Evaluation Plan
IER ..... Independent Evaluation Report
ILS ..... Integrated Logistic Support
ILSP .... Integrated Logistic Support Plan
INSCOM .. Intelligence and Security Command
IOC ..... Initial Operational Capabilities
IOE ..... Independent Operational Evaluator
IOT ..... Initial Operational Test
IOT&E ... Initial Operational Test and Evaluation
IP ...... Implementation Plan; Implementation Procedures
IPR ..... In-Process Review
IRS ..... Interface Requirements Specification
IS ...... Information Systems
ISC ..... Information Systems Command
ISEC .... Information Systems Engineering Command
ISS ..... Information System Security
IV&V .... Independent Verification and Validation

JCL ..... Job Control Language
JT ...... Joint Test

LCSEC ... Life Cycle Software Engineering Center
LEA ..... Logistics Evaluation Agency
LOB ..... Left-of-Baseline
LOC ..... Line of Code
LSVT .... Lead Site Verification Test
LUT ..... Limited User Test

M/S ..... Modeling/Simulation
MACOM ... Major Command
MAISRC .. Major Automated Information System Review Council
MANPRINT Manpower and Personnel Integration
MARC .... Manpower Requirement Criteria
MATDEV .. Materiel Developer
MCIR .... Materiel Change Information Report
MNS ..... Mission Needs Statement
MOA ..... Memorandum of Agreement
MOE ..... Measure of Effectiveness
MOP ..... Measure of Performance
MOT ..... Multi-service Operational Test
MP ...... Management Plan

MRRB .... Materiel Release Review Board
MS ...... Milestone
MSC ..... Major Subordinate Command
MSCR .... Materiel System Computer Resources
MSP ..... Mission Support Plan
MTBF .... Mean Time Between Mission Failure
MTTR .... Mean Time to Restore

NDI ..... Non-Developmental Item
NHPP .... Nonhomogeneous Poisson Process
NIST .... National Institute of Science and Technology

OA ...... Operational Assessment
OE ...... Operational Evaluator
OEC ..... Operational Evaluation Command
OMA ..... Operations and Maintenance Army
OMB ..... Office of Management and Budget
OMF ..... Operational Mission Failure
OMS/MP .. Operational Mode Summary/Mission Profile
O&O ..... Operational and Organizational Plan
OPA ..... Operations/Procurement-Army
OPTEC ... Operational Test and Evaluation Command
ORD ..... Operational Requirements Document
OSUT .... On-site User Test
OT ...... Operational Test
OT&E .... Operational Test and Evaluation
OTP ..... Outline Test Plan
OTRR .... Operational Test Readiness Review
OTRS .... Operational Test Readiness Statement

PA ...... Proponent Agency
PCA ..... Physical Configuration Audit
PDL ..... Program Design Language
PDR ..... Preliminary Design Review
PDSS .... Post-Deployment Software Support
PEO ..... Program Executive Officer
PF ...... Program Folder
PM ...... Program/Project/Product Manager
POI ..... Programs of Instruction
PPQT .... Pre-Production Qualification Test
PR ...... Problem Report
PT ...... Test Plan

QA ...... Quality Assurance
QAD ..... Quality Assurance Directorate
QIO ..... Quality Improvement Office
QQPRI ... Qualitative or Quantitative Personnel
Requirements Information

RADC .... Rome Air Development Center
RAM ..... Random Access Memory
RAM ..... Reliability, Availability, Maintainability
RDTE .... Research, Development, Test and Evaluation
RFP ..... Request for Proposal
RGT ..... Reliability Growth Test

ROB ..... Right-of-Baseline
ROC ..... Required Operational Capabilities
RT ...... Test Analysis Report

SAT ..... Software Acceptance Test
SCART .... Software Corrective Action Review Team
SCP ..... Software Change Package
SDC ..... Strategic Defense Command
SDD ..... Software Design Document
SDF ..... Software Development Folder
SDIO .... Strategic Defense Initiative Office
SDL ..... Software Development Library
SDP ..... Software Development Plan
SDP ..... System Design Plan
SDR ..... System Design Review
SDT ..... Software Development Test
SEE ..... Software Engineering Environment
SEI ..... Software Engineering Institute
SIT ..... System Integration Test
SLOC .... Source Line of Code
SOP ..... Standard Operating Procedures
SOW ..... Statement of Work
SPCR .... Software Problem/Change Report
SPM ..... Software Programmer's Manual
SPR ..... System Post-Deployment Review
SPS ..... Software Product Specification
SQA....... Software Quality Assurance
SQPP .... Software Quality Program Plan
SRR ..... System Requirements Review
SRS ..... Software Requirements Specification
SRTM .... Software Requirements Traceability Matrix
SS ...... System/Subsystem Specifications
SSDD .... System/Segment Design Document
SSEB .... Source Selection Evaluation Board
SSG ..... Software Sub-Group
SSR ..... Software Specification Review
SSS ..... System/Segment Specification
SST ..... Supplemental Site Testing
SSTP .... Software Support Transition Plan
STD ..... Software Test Description
STEP .... Software Test and Evaluation Panel
STP ..... Software Test Plan
STP ..... System Integration Plan
STP ..... System Test Plan
STR ..... Software Test Report
STR ..... Software Trouble Report
STSC .... Software Technology Support Center
SW ...... Software (also referenced as S/W)

TCIC .... Technical Critical Issues and Criteria
TD/CMS .. Technical Data/Configuration Management System
TDP ..... Test Design Plan
TE ...... Developmental Evaluator
T&E ..... Test and Evaluation

TECOM .... Test and Evaluation Command
TEMP .... Test and Evaluation Master Plan
TEMPEST .. Control of Compromising Emanations
TEP ..... Test and Evaluation Plan
TER ..... Test and Evaluation Report
TEXCOM .. Test and Experimentation Command
TIR ..... Test Incident Reports
TIWG .... Test Integration Working Group
TP ...... Test Plan
TQM ..... Total Quality Management
TR ...... Test Report
TRADOC .. Training and Doctrine Command
TRR ..... Test Readiness Review
TSARC ... Test Schedule and Review Committee

UFD ..... Users' Functional Description
UM ...... User Manual
US ...... Software Unit Specification

VCSA .... Vice Chief of Staff of Army
VDD ..... Version Description Document
V&V ..... Verification and Validation

WBS ..... Work Breakdown Structure